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ABSTRACT

One of the working papers in the final report of the Arizona Board of Regents' Task Force on Excellence, Efficiency and Competitiveness, this document focuses (in Part I) on the summary, conclusions, and recommendations of future changes and their relationship to the Arizona Universities; and, (in Part II) provides background materials for developing those conclusions. Part I discusses the range of possible futures in Aizona over the next 20 years according to: principal driving forces and emerging trends; demographic trends; economic changes; health and environment issues; political shifts; social values; and technological innovations. Common assumptions are challenged and potential scenarios are presented. Some possible high-impact events noted are biotechnology breakthrough, economic depression, instability in Mexico, a major nuclear energy accident, space manufacturing, and terrorism. Implications of changes for Arizona universities are noted. Some of the 11 conclusions are: recognize that Arizona has a population in transition; forecast accurately the enrollment futures of the universities; and identify realistically university strengths and weaknesses. It is recommended that the universities develop foresight capability in support of strategic planning and current decision processes. Part II presents background studies, national studies and sources, and general issues (technological, economic, demographic, health and environment, social, and political). Contains 35 references. (SM)

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FUTURE CHANGES: IMPLICATIONS FOR ARIZONA'S UNIVERSITIES

ROGER L. CALDWELL

PREFACE

This working paper contains two separately bound sections. Part I is the summary, conclusions, and recommendations of future changes and their relation to the Arizona universities. Part II provides background materials for developing those conclusions and is included as supporting documentation.

The primary results of an environmental scan are summarized in Part II of this working paper; additional details may be found in the working paper "Arizona Environmental Scan Study."

There are several Task Force working papers that provide related information:

1. Opportunities for Telecommunication for University Outreach in Arizona.
2. Executive Summaries of Reports and Books on Higher Education.
3. Arizona Environmental Scan Study.
4. Some Thoughts About Approaching the Future of Arizona.
5. Foresight: Definition and Need for Arizona Universities.
6. Strategic Planning and the Arizona Universities.
7. Enrollment at Arizona Universities: Forecasts to 2000.
8. University Research and Economic Development in Arizona Today: A Working Paper.
9. Arizona Universities in Transition.

I would like to thank numerous reviewers of early drafts of this report, both within and outside the university system.

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PART I.

SUMMARY AND RECOMMENDATIONS

PURPOSE

The purpose of this Working Paper is to identify a range of possible futures in Arizona during the next 20 or so years of most relevance to the universities. This should be done in such a way that the Arizona universities will have a framework within which to identify relevant events and desired actions. This framework would then allow university development of plans for some anticipation of the future needs and events in

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Arizona. While it is not possible to predict the future over long periods, informed decisions made today, based on observation and understanding of the forces of change, can cause particular future outcomes.

The design of this paper contains three main parts:

1) identifying six broad areas of driving forces of change and listing selected trends to represent the range of possible events likely from these driving forces,

2) presenting four scenarios that group the trends in different combinations (and some unlikely but possible options), and

3) summarizing the implications for the Arizona universities identified by studying these scenarios.

It is not the purpose of this paper to forecast near term (one to two years) changes, but to identify a range of possible and plausible futures for purposes of developing a strategic plan (5-10 year range). This is done largely by summarizing existing studies and adding a small amount of new material.

OVERVIEW

There are few times in history when major shifts in society occur to such an extent that the shift can be labeled as the beginning of a new era. Examples include the agricultural and industrial revolutions and, more recently, the information or knowledge revolution and the emerging biological revolution. When one is a participant in such a dramatic change, it is difficult to comprehend the scope and implications. Those with vision are better able to grasp the overall essence of the new conditions. With a few guiding principles, these visionaries can navigate the currents of changing times with an advantage relative to others who are reacting to old events or are dependent on simple extrapolations of past trends. We seem to be in a period of such fundamental change and need to pay particular attention to early warning signals of change that are not readily evident.

If one develops a "mindset" that recognizes the central themes of these changes, then many other details follow much more easily, as there is a frame of reference for everyday observation and decision making. Examples of some of these central themes include shifts in population patterns, underpinnings of the economy, and anticipated technological changes.

Further, the need for continuing analysis and evaluation of options, living with uncertainty, and managing change will be critical to a better understanding of how to make decisions today. The challenge is to identify and understand sufficiently the forces of change to recognize critical areas of concern, and not be misled by following historic trends that may no longer be relevant or even real.

Universities are in the knowledge business. This includes the presentation and analysis of existing knowledge, the acquisition of new knowledge through research, and the transfer or packaging of knowledge to students and off-campus clientele. This fundamental activity of the university is worthy of an analogy, as the methods for performing these activities vary with time and sometimes get confused with the basic product. The analogy relates to the old time railroad industry. Believing it was in

the railroad business rather than the transportation business, the railroad industry fell prey to successful competitive alternatives developed by others. The same competitive situation exists today for universities, as new and existing firms and organizations become more involved in information technology.

Some examples might include the impressive growth of private institutions such as the University of Phoenix and the existence of Texas-originated satellite-delivered programs to Arizona primary schools.

The implications of possible changes to universities are significant but require further research and debate to better understand which actions to take.

There are many changes to consider, including the impacts of new technologies, results of changes on societal values, possibility of information overload, cooperative efforts among groups or individuals for integrated problem solving techniques, and the development of new job categories.

These all require significant university based actions. Finally, whatever the university response, it will not come easily. The infrastructure must be capable of responding to change even when the best direction may not be clear, or the forces of change might be directed from outside the university.

APPROACH

The approach to studying future trends and issues for this report differs from that of typical studies. This approach presumes that it is better to have a range of options for study and understanding, rather than a detailed listing of specific predictions or forecasts, even though some details are necessary to identify a broad understanding of current or emerging trends. One of the difficulties of assessing future choices in a time of fundamental change is that conflict may surface between those following the "old" understandings and those believing they see "new" trends. It is often difficult to identify relevant data or to expose trends that may go counter to the expectations of those in highly visible positions. Accordingly, the report focuses on probable major changes and their impacts on the universities rather than extrapolating a number of existing trends in detail.

This working paper briefly summarizes important national and state studies on the subject, related studies completed recently by the Regents or universities, and abstracted results of Task Force staff interviews. The paper outlines emerging trends and possible discontinuities. From these, a listing of principal driving forces are identified, with selected possible trends listed. A series of possible scenarios and their impacts on universities is presented. Finally, a list of conclusions and recommendations believed significant for action by the Arizona universities is identified.

LIMITATIONS

There are certain limitations to any study of the future. Studies are influenced by the study purpose, stated or unstated assumptions and definitions, background of the authors, requesting organization, and specific approach. There is no single "right" way to perform these studies, but there are potential traps for those that take conclusions at face value without developing an understanding of the study background.

PRINCIPAL DRIVING FORCES AND EMERGING TRENDS[1]

Numerous existing or emerging trends can be identified from multiple sources, although some provide contradictory information. Focusing multiple trends into a few "driving forces for change" allows a better summarization of the trends for our evaluation of changes that might affect the universities over the next decade or so.

Several specific trends can be selected from the many implied by the driving forces to better understand the implications of some of the expected changes. These are grouped into the same categories that described the driving forces, and are based on the background materials found in Parts II and III of this report. These trends will be used to build the scenarios and implications for the universities in the next sections.

DEMOGRAPHIC TRENDS

Changes in the population age distribution and recent migration patterns suggest the growth rate of Arizona will not be as rapid in the next 20 years as in the past 20; however, it will still be substantial. Shifts in age distribution are moving the dominant age group away from the prime migration years.

- Continued growth of the Arizona population above the national average, but at a slower rate than in the recent past.

- Changing ethnic, sex, and age mix of students and their reasons for attempting higher education.

- Minority representation will continue to increase in the general population and especially in the early school years.

ECONOMIC CHANGES

The economies of the United States and Arizona are increasingly international in scope. The world is getting smaller and countries are becoming more interdependent. The resolution of the national economic condition (debt and trade deficits) will have a long-term impact on the economy, particularly those sectors with significant federal funding. In addition, job creation will be shifting partly to service economies, will be dependent partly on new technologies, and will likely cause multiple training needs throughout a person's career.

Impacts of automation on manufacturing and especially service industries may cause an increase in people that are "unemployable" as non-skill jobs disappear. A substantive impact will be seen from small business and industrial concerns in providing employment.

There may be conflicts between the historic independent and competitive nature and the working together cooperatively that may be necessary in complex projects or international activities. Decreases in the number of young people entering the workforce and the increased number of part-time workers (especially involuntary second jobs) have made several current indicators of change (e.g., unemployment) less meaningful.

- Increases in number and activities of institutions and companies competing for the knowledge industry.

- Automation in the service sector (artificial intelligence and ease-of-use

interfaces between machine and human); flexible automation in the manufacturing sector by easily adaptable robotics to new processes within short time periods.

- Increasing mismatch between types of available jobs and types of college training and between jobs demanding college education and low-ability jobs.

- Increasing/decreasing inflation /interest rates depending on economic conditions.

- Large businesses will be much more information intensive with many fewer levels of management.

HEALTH AND ENVIRONMENT ISSUES

Continued concerns in natural resource and environmental issues, and in safety of food, air, and water supplies will likely invite additional government regulation. As urban areas increase and become very large, waste disposal and replacement needs for inadequate services become more evident. Costs of large-scale health problems such as AIDS, new drugs and test procedures, replacement body parts, and extended life spans will have very large but hard-to-anticipate effects on the economy, ethics and the workplace. Activities directed toward drug and other chemical abuse problems are likely to become more pronounced.

- Increased expectations for provision of medical care for workers and families.

- Extended life spans will compete for available medical services.

- Continued neglect of general civic education and "how to function in today's society" education at all levels.

- Dealing with impacts of "megacities" relating to congestion, waste disposal, rebuilding infrastructure of buildings/ roads/services.

POLITICAL SHIFTS

The roles of communities (extended family, neighborhood, work related, politically motivated) are changing. New information technologies allow disparate groups to coordinate efforts with rapid transfers of information. Political parties may produce a broader range of political options (rather than maintaining the two historic major parties). Political changes are occurring at both local and national levels, toward more involvement and interest by a broader group of people.

- Continued single-issue interests and strengths of some specific groups will be maintained.

- Changing influences of minorities, particularly in the Southwest, will affect historic political controls.

- Increased demand for human services provided by the state.

- Increased political influence of minority populations in Arizona (especially Hispanic and American Indian).

- Expectations of high level of services provided by government.

- Increased divisiveness between urban and rural interests (due to differences in economic categories of rural vs two major metropolitan areas).

SOCIAL VALUES

The values and attitudes of the population are changing and are difficult either to fully understand or to summarize. Rather than a single large group, there are several groupings (e.g., belongers, achievers, socially conscious, need-driven) and the relative significance of each changes over time. Early warnings exist for a shift to viewpoints reflective of greater tolerance, greater diversity of interests and greater social activitism.

- Increased needs for minority involvement across the various sectors of society are becoming more evident.
- Greater stress is likely to be placed on workplace benefits and other nonfinancial support for a changing workforce.
- Long-term social and health needs in competition with other needs for state funding.
- Fewer or greater very poor or very wealthy in the United States.
- Consumers will increase their collective strength for product quality and truth in pricing/advertising.
- Increases in a "permanent" underclass resulting from manufacturing and service automation and reductions in the size of the middle class.
- Impacts of alteration of societal support systems resulting from new technology (e.g., 24-hour access to computing systems that are based on decades old accounting and information handling processes; legal procedures in relation to telecommunications technology and "non-physical" evidence).

TECHNOLOGICAL INNOVATIONS

It is appropriate to refer to some changes in technology as revolutionary. These changes will significantly affect how society functions. Examples include information industries (e.g., computing, communications, storage and retrieval, artificial intelligence); biological technologies (e.g., synthetic drugs and hormones, life extension and body-part replacement); and synthetic materials or new ways of using natural materials (e.g., high strength, light, inexpensive materials designed for specific purposes). These changes in some cases will be pervasive throughout society and in other cases will have specialized impacts.

The impacts on society will be both positive and negative, and will elicit increased dialogue among technologists and non-technologists as to the appropriate role of these changes in society.

- Increased regulation of the biological sciences industry.
- Centralization/decentralization of technology in major firms or entrepreneurial firms.
- Increases/decreases in the amount of industrial earnings devoted to research and development.
- Increased rate of implementation of new technologies.

UNCERTAINTIES EXIST

There are uncertainties in interpretation of some easily available data. Three examples are given for illustrative purposes. First, the shift from manufacturing to service industries is clearly evident when reviewing employment data and their extrapolations.

The more obvious reasons for this are

1) manufacturing has increased in efficiency (productivity) through automation, and

2) labor intensive manufacturing has been transferred to other countries.

However, there are two other reasons for the relative increase in service industries: these industries have a greater number of part-time employees which are counted as equivalent to full-time employees in manufacturing, and some manufacturing activities are contracted to service industries (e.g., secretarial, job shops needs, design work). In addition, pay is generally less in service activities and some industries exist as "hollow" shells that only appear on paper as organizations.

These types of shifts between traditional job classifications are complicated by the development of new jobs (e.g., information technology specialist, biotechnology technician). Examples occur of employees becoming "intropreneurs" within their own company where innovation can take place even in traditional organizations; these too are hard to see, as they appear as historic organizations when viewed from the outside.

Another uncertainty is the rate of migration between states and the immigration rate into the US (legal and illegal). The age distribution has moved the U.S. baby boom group into the age where migration has been much lower, likely causing a slower growth rate for states like Arizona in the next 20 years compared to the last 20 years.

While it seems reasonably certain the overall national migration rate will slow, the actual numbers of migrants for specific states are hard to determine.

Other factors suggest further slowing of Arizona's growth rate due to revitalization of the northern or midwestern cities or increased pollution in Arizona cities. On the other hand, this reduction in population growth rate might be off-set by impacts of any further decreases of quality of life in states like California.

Finally, we can make some estimates of what might happen to the labor market. The facts which are easy-to-gather suggest continued low unemployment rates because of continued economic growth with a lessening number of young entering the labor pool. The trends suggest an extended working period as functional life spans increase and attitudes about forced retirement continue to change. The uncertainties arise from several possibilities: transfer of older workers to fill jobs younger workers once filled (e.g., fast food franchises); competition of middle-aged (baby boom bulge) workers for management positions when those positions are decreasing in number; increasing immigration of foreign workers to fill menial jobs; and extended working opportunities for the post-65 population.

The implications are significant but unclear: frustration and career shifts by

middle-aged employees, combining flex working time and flex vacation schedules, accommodating new work options for joint employee work with a single job position, increased day care opportunities, benefit needs shifting from financial to non-financial benefits, increased formal retirement ages, and retraining actions for multiple career lifetimes.

CHALLENGING COMMON ASSUMPTIONS

HIGH TECHNOLOGY AND JOB CREATION

Assumption:

High technology industries will be a primary creator of professional jobs.

Response:

In the five year period 1987-1992 there are more Arizona jobs anticipated in health care (over 26,000) and education (over 27,000) than in engineering related occupations of all types (19,000); for physical and biological sciences combined the total is less than 1,300. In addition, most job categories do not require advanced education and these are in some of the most rapidly growing service classifications.

INSTITUTIONAL INERTIA AND CHANGE POTENTIAL

Assumption:

Universities are perceived by some as difficult to change because of the faculty tenure process and autonomy from external controls.

Response:

In the Arizona universities dramatic change has occurred in response to changing conditions; however, most of this change has developed through adding new programs and activities rather than redirecting old ones.

This has been made possible by growth in faculty numbers and a funding process that allows redirection of existing funds and requests for new program funds within the discretion of the universities. On the other hand, the universities could be accused of responding only to selected changes taking place in the state environment. Leadership and commitment (along with appropriate incentives) are more important in changes of this type than historic trends.

MINORITY INVOLVEMENT IN EDUCATIONAL OPPORTUNITIES

Assumption:

Minorities have nondiscriminatory opportunities just like other segments of society.

Response:

While minority- and low-income-student access to higher education meets equal opportunity standards, there are still numerous barriers for these groups to effectively complete college education; there is de facto limited access. Part of this limitation is rural isolation, which disproportionally affects American Indians and Hispanics. Examples include financial limitations, cultural changes, and early educational preparation.

POPULATION GROWTH AND MIGRATION RATES

Assumption:

Arizona's population growth will continue the historic rapid growth, and past trends can be extrapolated for estimates.

Response:

Population growth will slow due to the changing age structure, putting the baby boom bulge past the age of highest migratory potential; northern cities no longer have the same conditions that forced or encouraged people to leave during the last 20 years and have been receiving population increases, and the previously satisfying amenities in Arizona are in question (air and water pollution, traffic congestion, or even sunshine).

SCENARIO DEVELOPMENT

OVERALL ASSUMPTIONS

There are several assumptions that are sufficiently likely that they are included in all scenario examples. These include the internationalization of the economy, the shifting population age structure, and impacts of technology. All of these changes will have dramatic effects in the political, economic, social, and educational systems in Arizona.

SCENARIO A

(Business as Usual)

The economy and political attitudes follow the course of recent years, remaining generally conservative. The economic growth period continues with only minor and infrequent recessions, and the debt and international trade balances trend toward zero by slowing spending rather than increasing taxes. The service sector increases as a percentage of the labor force; limited competition is seen for educational services from non-education institutions. Economic growth in the range of 2.5 percent annually.

SCENARIO B

(Strong Economic Growth)

The economy grows more rapidly than recent past, fueled by increased exports and increases in productivity in both the manufacturing and service sectors. Disposable income increases moderately and major breakthroughs occur in specialized technologies. These changes which allow major increases in productivity the service sector and manufacturing sectors also reduce the need for trade, as products can be made efficiently and flexibly, with rapid changes to meet demand either close to the manufacturing plant or distant. Growth rate of the economy in the range of 3.0 percent annually.

SCENARIO C

(Strong Economic Downturn)

Significant changes occur as a result of prolonged and significant economic downturn, causing serious reductions in federal and state spending; social unrest increases because of an increased size of the lower class and further break up of family structures. An increase in the aging population along with a decrease in numbers of young workers causes more "retirement" age workers to remain in the workforce, but in lower-paying jobs.

Productivity does not grow and new technologies are either not economically

developed or are unable to penetrate the economy in any significant amount.

SCENARIO D

(Mild Economic Downturn)

The economy slows with recession by the early 1990s, consumer spending slows, taxes increase, and government spending shifts from defense to societal programs. Cooperative efforts increase between education, government and industry to permit increased competition with other nations.

The government increases regulatory activities, student activitism increases, businesses focus more on minority interests, and the labor force remains constant as older workers offset losses in younger workers. Employees become a greater part of the organization, with a "sense of family" due to greater flexibility of benefit options and communication of institutional directions.

Technological impacts increase life expectancy and lead to development of new drugs, miniaturized and powerful computers increase productivity in the service sector but computer crime increases and ethical questions are raised about organ transplants and life extension proposals. Economic growth on long-term basis about 1.5% annually.

UNLIKELY BUT POSSIBLE HIGH-IMPACT EVENTS

There are events that have a low probability but potentially a major impact, or others with seemingly minimal impact, while still uncertain, have sufficient likelihood that their impacts will be significant. These types of events need to be planned for, not because they might occur, but because the exercise of thinking through the possible implications for the university will lead to better understanding and responses to all types of uncertain events. A recent example of this type of event would be AIDS. A new disease with rapidly escalating costs but also understanding, and secondary impacts beginning to show up (e.g., increases in health/life insurance rates, revised sanitation procedures in the medical profession). While any one event may not have a high probability, it is likely that some event of this type will occur within the next 20 or so years.

POSSIBILITIES OF SUCH EVENTS INCLUDE:

BIOTECHNOLOGY BREAKTHROUGH[2]

While biological science breakthroughs are likely, the specific events and the societal impacts are uncertain. New molecular level synthesis becomes available on a large scale, allowing multiple new drugs, new pesticides, new immunizations for major diseases, and new industrial products.

This may cause:

- Significant increases in the life span with the resulting impacts on retirement, job openings, and leisure time activities.

- Increased conflicts about who receives these life-sustaining drugs or operations.

CALIFORNIA MIGRATION CHANGES[3]

The rate of in- and out-migration between Arizona and California is significant and is the most volatile of all state transfers. In 1984-85 California accounted for 23% of all out-migration

and 16% of all in-migration. If there were something that changed that ratio, it could significantly affect the net growth rate of Arizona.

Some examples might include:

- Increasing concern in California with quality of life factors such as urban congestion, air pollution, leisure time distances, and crime (although several of these factors in Arizona are approaching the same concerns as in California).
- Increasing job relocation to Arizona due to costs of doing business in California.
- Increasing concern in California about potential earthquake hazards, either through fear of the "big quake" or by experiences with a series of smaller quakes. The probability of a big quake in the next 30 years has been placed between 40 and 60%, and smaller quakes occur with some frequency.[4]

The migration history has largely involved Whites rather than being reflective of the California ethnic mix. This could change.

ECONOMIC DEPRESSION[5]

Actions taken by the US to stimulate the economy and to mitigate the national debt and related international debt prove ineffective.

- Unemployment increases dramatically and values of institutional and private investments fall; inflation increases rapidly, multiple bankruptcies cause assets to change hands with assets deflating in value.
- People do not participate in society but retreat into small "trusted" groups; spending and investment drop markedly, living standards drop, and the world power of the U.S. declines markedly.
- Society becomes barbaric due to confusion, lack of historic support structures (extended family), and lack of ability to be self sufficient.
- Chaos develops as people struggle to cope and business and government find ways to manage the situation under difficult conditions.

INSTABILITY IN MEXICO[6]

The population of Mexico is 84 million in 1987 with an anticipated 105 million in 2000 and 138 million in 2020. The proximity of a third world country to the developed country status of the United States causes increased stresses for those dealing with both countries.

- The long-standing political vitality of the ruling PRI party is becoming vulnerable to challenges. The steady control of a single party system on the general economy and social structure loses this stabilizing influence.
- International debt continues to drain necessary capital from development and needs generated by rapid population growth.
- Long-standing tensions between the varying economic classes intensifies as greater differences between the haves and the have-nots become evident.
- Changes in settlement along both sides of the border due to immigration

will affect communities in the Southwest (perhaps an Arizona version of multicultural Miami, Florida), and border relationships (militarization, by both nations, of the border?).

MAJOR U.S. NUCLEAR ENERGY ACCIDENT[7]

There have been several events of the energy production type in the recent past (Three Mile Island and Chernobyl power plants) but there are additional nuclear-related possible events. With increasing tension in the Persian Gulf and new concerns for atmospheric pollution (Greenhouse Effect and Acid Rain) the interest in nuclear power has been renewed.

- o Accident-related electrical power plant breakdown with loss of atmospheric radioactivity.
- o Damage to structures (e.g., earthquakes, structural decays) containing radioactive materials which then contaminates underground water sources, or disrupt transportation facilities.
- o Terrorist attacks on nuclear facilities or theft of radioactive materials.

MIDDLE EAST INSTABILITY[8]

Tension in the Middle Eastern countries is not likely to abate soon, and the potential for some disturbance is high. Possible impacts include:

- o Conflict or political choice to disrupt the flow of international oil, causing a ripple effect throughout the oil consuming countries and a new version of the mid 1970s energy embargoes. In the initial 1973 embargo, the United States imported 17% percent of its oil from the OPEC countries; in the 1978 price shock it was 31%, and in 1987 the figure was 18% percent; the dependence on OPEC countries has been growing since 1985 after an eight-year decline.
- o Political instability leading to limited and conventional war by major countries, or nuclear war by terrorist groups. Implications of additional terrorism in US precipitated by actions taken by the US in the Middle Eastern (or other) area.

SPACE MANUFACTURING[9]

New manufacturing techniques available only in space become economically viable.

- o Separation of drugs into high purity components under zero gravity conditions to make available new disease combating tools.
- o Crystal formation under zero gravity conditions produces new materials for high tech manufacturing.
- o Low cost development of materials from the moon allows construction of space station capable of harnessing solar energy and beaming this energy to earth.

EARLY RESPONSES TO GREENHOUSE EFFECT[10]

The greenhouse effect is caused primarily by release of carbon dioxide into the upper atmosphere, causing the sun's heat to enter the earth's atmosphere but not to be released. This warming observation is similar to how a greenhouse functions (sun's rays enter but the heat stays in), and it has been

referred to as the "greenhouse effect." The long-term impact is a gradual warming of the world. The short-term impacts (next decade or two) might include:

- Gradual warming in upper latitudes causing ocean rises and flooding of coastal areas.
- Gradual increase in frequency of drought in agricultural areas and associated underground water supplies; movement of the food production zones of the US to a northern direction.
- Increasing perception of business and industry concerning moving to Arizona because of fears of future water shortages.

TERRORISM STRIKING UNITED STATES[11]

Terrorism comes to U.S. soil as a result of worldwide terrorism and increasing conflict in specific parts of the world.

- Disruptions in electrical transmission systems and power generation plants.
- Societal disruption by release of toxic materials or contaminated water supplies within large urban areas.

IMPLICATIONS FOR ARIZONA UNIVERSITIES

EXTERNAL ENVIRONMENT

The universities exist in a broad environment, where trends are continually changing. Some possible events will affect the university primarily from the outside (e.g., economic conditions, demographic shifts), but others will be more subtle (e.g., student interests, minority enrollments). All will require monitoring the environment to become aware of the close relationship of the state and the community with the universities.

ENROLLMENT

Enrollments are shifting to accommodate more nontraditional students, but these increased enrollments may not necessarily cause increased numbers of students on the physical campus (through use of communications technology or off-campus centers). Increased competition will exist in the 1990s as the nationwide high school graduate pool declines. The range of possible external events and options open to university administrators allow for wide ranges in enrollment projections, although with the exception of the next five or so years, the projections are all growth oriented. Private institutions for higher education in Arizona may become increasingly important.

PROGRAMS AND CURRICULUM

Academic programs (teaching and research) will shift slowly to include more interdisciplinary studies (while continuing to maintain strong traditional disciplines), lifelong learning needs of a changing workforce, and a student body changing by age, values, and location. Increased emphasis on international studies, with particular reference to the Pacific Rim countries and Mexico. Some programs will be eliminated and others will take their place. The curriculum is likely to become more flexible, with more interdisciplinary offerings, more attention to undergraduate critical thinking skills, and be obtainable on- or off-campus at a variety of times. Disciplines may have

increased blurring of their edges as a renewed interest in interdisciplinary programs surfaces. The problems and opportunities of both society and research needs do not necessarily fit the traditional academic disciplines; those universities that have flexibility to allow new programmatic structures will be at a competitive advantage. Program duplication or needs for a "critical mass" to allow an offering will come under increasing review.

MANAGEMENT

The university could respond as many business and government institutions will respond to the changes in increased efficiency and decreased middle management, and increased communication and involvement with workers and clients. Changes in the infrastructure of universities are likely as new requirements are faced and as older processes are replaced by those more efficient. New activities in assessment of a quality product and of affirmative actions toward minority students will increase the administrative costs.

RESOURCES

Resources will become more difficult to obtain, and may have additional constraints on use. Competition will increase on federal and private funds as other universities increase their focus on excellence as the Arizona universities are doing. The physical and capital infrastructure of the university will be increasingly of concern. As rapid change takes place, especially in high technology fields, students and researchers must have relatively modern equipment to function. This rapid change of the technology outpaces the ability of the "system" to respond to replacing equipment and facilities.

UNIVERSITIES AND THE COMMUNITY

The relationship of the university to the community could become more positive or negative, depending on the perception of university actions and their reasons by the community. Within this context, community includes citizens, business, industry, and government. It also includes the faculty, staff, and student community within the university. We determined some viewpoints in our surveys and discussions which indicate that improvements in the area of community relations suggest special attention should be placed here.

IMPORTANT CHOICES

The strategic planning process is the mechanism to effect changes within the university structure. The range of new needs for the university will necessitate discarding or restructuring some of the old. Continued interest in excellence and competitiveness will require that resources be focused in few areas. Some of the central issues might include:

- Undergraduate quality and citizen access (including the impacts of enrollment caps either at the discipline or university level.

- Academic program selections for reallocation of existing and allocation of new resources based on: 1) maintaining excellence, 2) achieving excellence for departments already good, 3) maintaining average effort, 4) maintaining minimal effort, and 5) phasing out a program or activity (or combining with another program or department).

- Academic program selections for emphasis based on national or

international audiences compared to state audiences.

- Relative emphasis on programmatic choices (e.g., building disciplines) or on infrastructure (e.g., building support activities).

- Determining university-wide priorities vs college priorities.

Addressing strategic questions is difficult. However, if it is done openly and forthrightly the choices made today will allow significantly different futures for our universities. While there is much uncertainty about the future, there is also a considerable listing of high probability trends that are not adequately addressed in our current planning and analysis efforts.

TOMORROW'S ARIZONA UNIVERSITIES: A VISION

Within the next 20 years there could be significant changes in the university or the university could look very much as it is today. The difference is how we well we understand the future options and how well we make today's decisions.

The university is likely to have a very different student mix, with a much greater proportion of students of nontraditional age and special classification taking classes in nontraditional ways at the locations of their choice. Instructors will include teams from several different universities providing the lecture, and in private electronic communication with the students. The role of the university in overall society could be much more significant than today, as the basic function of the university (acquisition and transfer of knowledge) meets the new technologies developing in society.

Research will be both specialized and interdisciplinary, and will serve the nation and world as well as the state in both basic research and applied problem solving. Because of the continuing rapid growth of available information, specializations in "certain generalities" will emerge, as the specialists become too specialized for broad communication with other members of society.

Faculty, staff, professionals, and administrators will have their knowledge device (today we refer to this as a computer terminal) available both for information for decision support and also as a consultant on difficult issues; this will function by new data storage techniques and artificial intelligence interactions with the computer.

The university is a unique structure in both historic and modern society. It is one of the few places where the difficult issues can be debated in an open forum and the dialogue is available for public viewing and involvement. It is an institution that involves both teaching existing knowledge and researching new knowledge, as well as providing new information and cultural events to the public.

TODAY'S ARIZONA UNIVERSITIES; A STATUS REPORT

The Arizona universities have made significant changes in their curricula and programs over the last 25 years.[12] There are still clear traces of the historic past of each university, and the differing clientele for each are reflected in the types of degrees awarded[13]:

Arizona State University

Bachelor Degrees	Masters Degrees	Doctoral Degrees
Business (30%)	Education (22%)	Education (40%)
Education (11%)	Business (18%)	
Engineering (8%)		

Northern Arizona University

Bachelor Degrees	Masters Degrees	Doctoral Degrees
Business (19%)	Education (60%)	Education (83%)
Education (14%)	Business (18%)	
Social Science (6%)		

University of Arizona

Bachelor Degrees	Masters Degrees	Doctoral Degrees
Business (25%)	Education (25%)	Education (30%)
Engineering (15%)	Engineering (13%)	Phys. Science (11%)

National Average

Bachelor Degrees	Masters Degrees	Doctoral Degrees
Business (24%)	Education (27%)	Education (23%)
Education (10%)	Business (23%)	Life Science (10%)
Engineering (10%)		Phys. Science (10%)

The greatest changes in the universities have occurred in building certain disciplinary strengths (Engineering at ASU, Physical and Biological Sciences at the UA, and Education at NAU) and their attraction for externally generated research and development funding. While the Arizona universities are clearly different, they also have some remarkable similarities, and are maturing campuses.

MOVING TO THE FUTURE

The strengths of the universities today partly mirror the expected changes in the future needs and events. But they also are lacking programs in some areas that will be important in the future, and these areas will have to be evaluated for possible emphasis by the universities. As Arizona is a rapidly growing state, we can take advantage of that growth as resources continue to be made available for higher education. For example, an annual 3.5% growth rate produces a 20 year doubling time; if we were to add resources to a particular area at 3.5% per year, in 20 years that area would have twice the funding of today.

The universities of 20 years hence will be able to take advantage of significant changes in newly available technologies for delivering knowledge. The expertise associated with the many disciplines at the universities will be available to the state as we move thorough times of uncertainty and possible crisis. Some things will remain, as the universities will also continue to be areas of fundamental inquiry into new knowledge and provide basic education to Arizona citizens. The university will not simply steer itself into the future. It will take strong leadership and committed participants. While other institutions have made dramatic changes, the external conditions were more conducive to some of those changes in the past.

There are several guiding principles to help us get to a desirable future for the universities.

- o Develop an understanding of likely future changes in the external environment, professional directions, and societal needs.
- o Identify institutional strengths and weaknesses and match these to these external changes, finding the best match for selected areas in which to focus effort.
- o Maintain a high degree of flexibility to allow rapid response to changing circumstances, but move with general consistency toward a "vision" of where

the university should be going (so not every opportunity should be taken).

The first two guidelines are descriptions of a strategic planning process. The third guideline is difficult to manage but necessary considering the turbulent and unpredictable times in the next decade or so.

CONCLUSIONS

When previous studies (national, state, university) are reviewed, it is clear that many issues identified in this paper are not new. The challenge, therefore, is less in recognizing problems and identifying possible solutions, than in developing a means of implementing study results.

Because of the changes taking place both inside and outside the universities, we will have to develop outlooks that allow us to:

1. Understand the need and develop the means to operate under conditions of uncertainty, including an ability to accept the unanticipated and be prepared for sudden changes in the familiar; and initiate decision-making capabilities that allow flexibility and swift movement with autonomy within an agreed upon set of directions.

2. Identify realistically the internal strengths and weaknesses of the universities so the value of understanding external conditions can be fully realized.

3. Forecast accurately the enrollment futures of the universities even though the range of possible futures for Arizona is large.

4. Understand that many of the changes will have both positive and negative effects on the institutions and society,

5. Find and know how to use relevant information from among the vast amounts of available data.

6. Recognize that Arizona has a population in transition; during the early 1980s, for every four persons coming to the state three left. This makes it difficult to secure popular support for major investments in the state infrastructure.

7. Understand that local population shifts are occurring that are causing the population to become more multicultural with a rising number of Hispanics and American Indians. Additional assimilation is occurring for Asians and Blacks.

8. Realize job classifications will shift, requiring retraining and the use of telecommunications technologies for new distance learning or continuing education programs.

9. Recognize the need for accountability and assessment of product outcomes by educational institutions.

10. Realize that the pressure by minorities on the establishment organizations will continue to increase, forcing changes externally to the universities unless positive actions are taken by the institutions.

11. Recognize that institutions must develop the capability to evaluate and understand potential "ripple" effects of apparently simple decisions or events occurring either in the university or the environment.

RECOMMENDATION[14]

THE ARIZONA UNIVERSITIES SHOULD DEVELOP FORESIGHT CAPABILITY IN SUPPORT OF BOTH STRATEGIC PLANNING AND CURRENT DECISION PROCESSES.

In developing an ability to anticipate possible future alternatives (foresight), the Regents' staff and the universities should identify information sharing roles. The role of the Regents' staff should be focused on the broad issues which are factual and useful to all the universities (e.g., demographic trends, national educational policies, and regional needs). The role of the universities should be cooperative and complementary, while taking advantage of the special skills at each institution. The data and tentative conclusions should be shared fully by those participating in the process. This process should pay particular attention to possible discontinuities in trend extrapolations, identify emerging trends, and develop scenarios to understand the effects of unlikely but possible events.

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FUTURE CHANGES: IMPLICATIONS FOR ARIZONA'S UNIVERSITIES[15]

PART II: BACKGROUND STUDIES

NATIONAL STUDIES AND SOURCES

GENERAL ISSUES

These trends and issues area selected from the last year (July 1987 to July 88) of the Future Survey, a monthly publication identifying emerging issues within 17 broad categories.[16]

TECHNOLOGICAL

- Computer crime (relationship to economy and security) will grow
- Shortcomings of computer files causing legal issues to be raised
- Computer based instruction in formal education and in other training activities
- Artificial intelligence will increase "user friendliness" with technology
- Computer changes will bring about small, inexpensive, powerful computers. Impacts will be on storage/retrieval, group communication, medical components and robotics
- Training and education by communications will increase rapidly in next 10 years
- New forms of information transfer will become important (videotex, hypertext, CD-ROM); but beware of infoglut concerns about dealing with too much information.
- Biological revolution can increase great changes at the molecular level (could invite more regulation, lawsuits, and ethic considerations as well as major advances in industrial production, medicine, and agriculture); likely biochips for processing.
- Increased use of technology assessment for resolving large expenditures and major public policy issues (such as health care cost containment)

ECONOMIC

- Global competition, revival of older industrial cities at northern latitudes (with new technologies making northern cities livable).
- Corrections of current economic imbalances will be difficult and US, with shifts from consumption to production and saving.
- US is moving in several directions: to service/leisure society, shifting political orientation from conservative to liberal, declining politically and economically, moving to global economy and communication.
- The current economic situation suggests recessions or worse.

- Shift from military to economic competitiveness of super powers
- Threats to future prospects of employment
- Possible decline of US in world economy (not unlike British at end of 19th century).
- Overly optimistic forecasts lead to bad policy and crisis
- International economic shifts to the pacific basin
- International labor shifts as Japan and US become post-industrial
- US economy becoming bicoastal
- Management of organizations is changing in response to environmental and technical change; training in how to deal with corporate change is necessary
- Economy will slow noticeably in next few years and the consumer boom will end
- Labor force growth rate will decline (baby boom effect) causing firms to rethink the human resource policies
- Business "teams" will increase to target issues regardless oforganizational structure
- Standards of living in US are improving at a slower rate than in the past; low income grew least and high income grew greatest since late 1960s
- Shifts of the baby boom to retirement years in early 21st century will require restructuring of public and private retirement systems and redefinition of the term retirement.

DEMOGRAPHIC

- Aging of the population
- Widening age gap in different parts of world and increasing young in third world will exacerbate differences in developing and developed countries
- New immigrants and minorities
- World population continues to grow and related problems continue
- Pressures to migrate to the US are likely to increase (lowering of new entries into job force of US natives and population pressures in developing countries

HEALTH AND ENVIRONMENT

- Need for global sustainable development (issues of population exceeding the carrying capacity in some areas)
- Major health threat and responses to AIDS
- Uncertainty about environmental knowledge and impacts will bring advances and failures
- Need for interdisciplinary links/connections rather than narrow analysis and linear pursuit of narrow and uncoordinated objectives
- Inadequately addressed major environmental issues include: food production, soil erosion, and environment, toxic and solid waste production and management, risks associated with air pollution, and protecting biological diversity

- Actions are likely to be taken to head-off anticipated global warming trend of greenhouse effect (anticipated mid 21st century but increasing concern it could be more sudden than believed).

- Changing medical practices from "physical/biological" to "biocultural" for the whole complex of the patient

- Emerging health issues include cancer links with electrical radiation, and greater emphasis on drugs and alcohol, with continued concerns for chemicals and their effects on people

- Growing salinization, possible water shortages, forest declines internationally, alternatives to oil development

- Employer investment in preventative medicine pays off

- Urban congestion in transportation and airports increases

- Decisions will have to be made on who gets medical care with increasing number of old and increasing costs

- Medical ethics and right to die or right to treatment (rationing health care related to scarce technological resources and financial costs).

- Need for long term health care, involving access, resource availability, legislation, and financing methods

- Cost effective energy efficient options exist but existing barriers and subsidies favor existing methods

- Growing conflicts between solving energy futures by conservation and renewable sources vs nuclear power (complicated by the concern over growing US oil imports and global warming trends due to fossil fuel burning).

SOCIAL

- Increasing amount of information causes problems (too much to absorb) as well as advantages (get new views or data)

- We don't know very much about "futures analysis" but it is more complex than typical forecasting and involves uncertainty and options more than extrapolation

- Reconstruction of the national purpose

- Increases in enforcement of violent and property crime

- Shift of legal enforcement to citizens and private police from official police

- Terrorism (building from US involvement in affairs of other nations) or due to other reasons

- Massive urban unrest and civil disorder similar to 1960s (by 2000)

- Drug war continues to be lost even though some battles are won

- Changes in prison roles (alternatives) due to overcrowding

- Changes in Mexico will influence US/Mexico relations (possible democratization of political process and severe economic crisis)

- Addressing adult literacy needs (this area in becoming increasingly important and has high potential payoffs).

- Educational needs change from teacher certification and admission or graduation requirements to one where math and science, general literacy, and social/moral implications of technology, reasoning skills, capacity to adapt to change, and more creativity.

- Internationalization will cause education for global responsibility (foreign language competency, business expertise, information flows, professional expertise)

- Four tier US class structure (upper and upper middle class professional and managerial, middle class of technical and skilled workers, service class, and underclass)

- Traditional US social structure changing (middle class is shrinking) but future implications are not clear

- Increasingly hopeless underclass with widening gap from other classes

- Threats to families by making child rearing more difficult (especially economically)

- Increasing number of poor households

- Increases in "family support centers" with or without government assistance

- Self reliant communities through new financing and cooperation
- Increases in role of government in society (perhaps state more than federal).

Political

- Political cycles (30 year) will be evident by early 1990s with a shift to reform, idealism, liberal phase

- Shared international leadership in space exploration and majorprcblems (AIDS, drugs, environment, arms control); the reasons are compelling but the real actions or results require caution

- Increases in international cooperation for security and economy

- Third world development moves from simple economic to integrated

- Increases in government involvement related to security, health, and safety

- Treatment of extreme views on change by combination of factors (cooperation and competition, regulation and free market, generalists and specialists)

- Prevention of some potential terrorism by redefining nationalinterests of US

WORKFORCE 2000

In 1987 the Hudson Institute completed a study for the U.S. Department of Labor titled "Workforce 2000: Work and Workers for the 21st Century". That study concluded that four key trends will shape the last years of the twentieth century (emphasis in original):

- The American Economy should grow at a relatively healthy pace, boosted by a rebound in U.S. Exports, renewed productivity growth, and a strong world economy.

- Despite its international comeback, U.S. manufacturing will be a much smaller share of the economy in the year 2000 than it is today. Service industries will create all of the new jobs, and most of the new wealth, over the next 13 years.

- The workforce will grow slowly, becoming older, more female, and more disadvantaged. Only 15 percent of the new entrants to the labor force over the next 13 years will be native white males, compared with 47 percent in that category today.

- The new jobs in service industries will demand much higher skill levels than the jobs today. Very few new jobs will be created for those who cannot read, follow directions, and use mathematics. Ironically, the demographic trends in the workforce, coupled with he higher skill requirements of the economy, will lead to both higher and lower unemployment, more joblessness among the least-skilled and less among the most educationally advantaged.

The Hudson Institute further notes that there are six challenges:

1) stimulating balanced world growth,

2) accelerating productivity increases in service industries,

3) maintaining the dynamism of an aging workforce,

4) reconciling the conflicting needs of women, work, and families,

5) integrating Black and Hispanic workers fully into the economy, and

6) improving the education and skills of all workers.

In its annual Occupational Projections and Training Data, the US Department of Labor projects the fastest growing and declining occupations from 1984 to 1985.

Growing	(% Increase)
Paralegal personnel	97.5
Computer programmers	71.7
Electronic data process	68.7
Medical assistants	62.0
Data processing repairs	56.2
Electronics engineers	52.8

Declining	(% Decrease)
Stenographers	-40.3
Shoe machine operators	-31.5
Railroad brake/switch	-26.4
Railcar repairers	-22.3
Furnace operators	-20.9
Shoe workers	-18.6

TECHNOLOGY AND THE ECONOMY

In 1987 the Congressional Office of Technology Assessment (OTA) completed the study "Technology and the American Economic Transition: Choices for the Future." Their conclusion is:

"During the next two decades, new technologies, rapid increases in foreign trade, and the tastes and values of a new generation of Americans are likely to reshape virtually every product, every service, and every job in the United States."

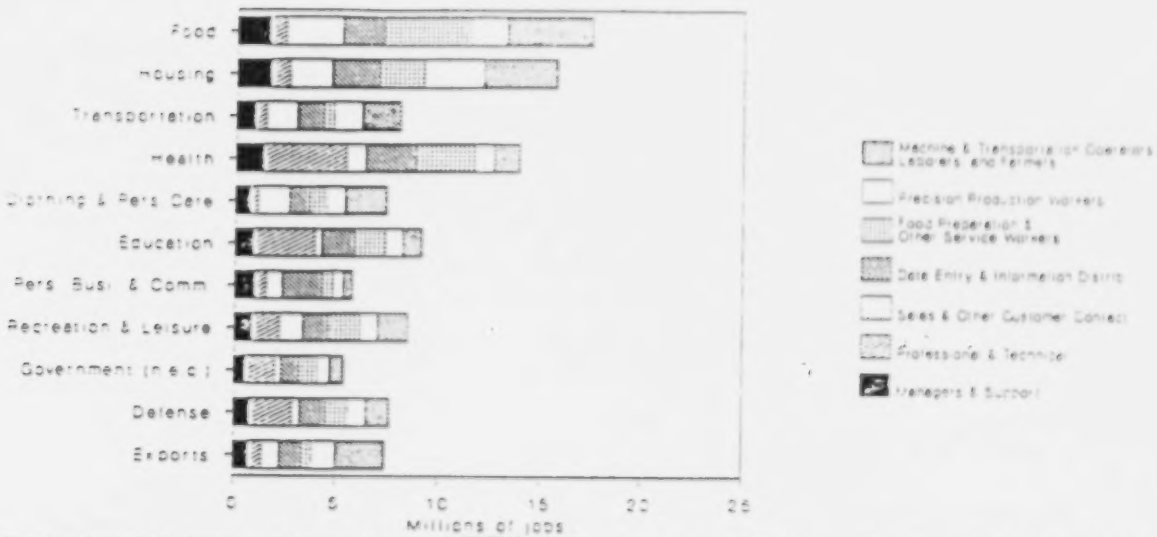
The four-year study took a new approach of understanding the interactions between the economy and technology, by breaking the economy into ten components (food, housing, health, transportation, clothing and personal care, education, personal business and communication, recreation

and leisure, defense, and government activities not elsewhere classified). The types of jobs allocated to these ten categories are shown in Figure 2.

century; and

- Changes in consumer and labor markets and a new attitude toward public regulation of economic activity,

Figure 2. Jobs Required to Provide for Category Amenities in 1984



How To Read This Figure: In 1984, the U.S. economy produced approximately 107 million jobs. Of this total, approximately 17.5 million jobs resulted from the production of food for U.S. households and government. Of these, approximately 1.6 million jobs were created for managers and management support occupations. All reported jobs in the U.S. economy are recorded somewhere in this figure.

SOURCE: Office of Technology Assessment (see table 10-6 of ch. 10).

They determine there are four new rules which are shaping the operation of the economy:

- New technologies (primarily those built around microelectronics);
- The loss of U.S. preeminence in the international markets;
- The possibility that the price of energy and other resources may increase sharply by the turn of the

resulting - at least in part - from new values and tastes.

While there is a good deal of discussion in the OTA report, they note that the Nation's educational system may be "on the brink of a major change" (resulting from a fundamental change in demand for educational services and the newtechnology making it possible to consider improvements in teaching and learning productivity). In addition, they note that earlier economic trans-

formations were associated with major public infrastructure investments (railroads, highways, electrical transmission lines), but the current transformation seems to involve an "educated population."

DEMOGRAPHIC CHANGES AND ECONOMIC AND SOCIAL CONSEQUENCES

In 1986 a subcommittee of the U.S. Congressional Joint Economic Committee held hearings titled "Demographic Changes in the United States: The Economic and Social Consequences into the 21st Century." The basic purpose of the hearings was to better identify the impacts of the demographic changes on education, labor, housing, health care, retirement, and the federal budget. The questions raised include: implications of an aging society (including institutional adaptation, health needs, jobs, economic support), slower growth rate of labor force allowing "at risk" youth greater opportunities in the job market, educational system capabilities in preparing a workforce requiring higher skill and competencies, increasing percentage of minorities (which make up greatest proportion of poverty and unemployment), increased need for cooperative efforts of labor and management, and caring for dependents (day care for young and varied care options for old). The major change in the proportion of "older" people will occur about 2010, as the baby boom population enters the late 60s.

In a related study a year earlier, the Office of Technology Assessment developed a report "Demographic Trends and the Scientific and Engineering Work Force." OTA concluded "that career choices and market forces have a greater impact on the supply of scientists and engineers than do demographic trends"; they further note that it is difficult to forecast the supply and demand of scientists and engineers, with the exception of academic market, which is expected to be weak over the next decade but strong after 1995.

The Congressional Research Service in 1983 identified ten emerging issues:

- Labor Force
- International Trade
- Information Society
- Changing Governmental Institutions
- Education
- Natural Resources and Food Scarcity
- National Infrastructure
- Armaments
- Research, Development and Innovation
- Health Care

The United Way of America develops an annual summary of changes talking place in the social, economic, political, technological, and other specialized areas. Some key observations (those not repeated elsewhere in these summaries) include:[17]

- Growing concerns around issues of generational equity
- Continued growth of single-person and single-parent households

- Continued high poverty rates in female-headed families
- Revival of confidence in institutions and businesses
- Continued growth of the corporate classroom
- Increased attention to illiteracy in U.S.
- AIDS epidemic increasingly critical; drug use to become more visible
- Slowdown in recent erosion of middle class
- Number of children in poverty to grow, increases in runaways
- Greater availability of child care and flexible hours in workplace
- Prevalence of conservative mood and regrouping of Democratic party to more conservative agenda
- Growing influence of state legislatures and decentralization of government
- Revised patterns of individual and corporate spending due to new tax code
- Significant growth of alternatives to courtroom litigation
- Advances to occur in microelectronics, biotechnology, telecommunications, computers and materials development
- Continued ethical concerns over technological advances, particularly in biotechnology
- Most new jobs in high-tech industries will be in nontechnical service areas
- Growing problem of workers displaced through technological advances
- Continued difficulty in maintaining a work force with sufficient high-tech skills
- Increased corporate support for human services not previously supported (e.g., drug abuse, child abuse).

MAJOR TRENDS

There are several available listings of "trends" as seen from the perspective of person or group preparing the listing. Some have been identified in this section on National Studies and Sources, others that are more focused have not been listed. One recent study is worth further identification because of comprehensive nature.[18]

Trends (71 overall) are identified for the following categories:

- General Long-Term Societal Trends (9)
- Technology Trends (8)
- Education (8)
- Labor Force and Work (14)
- Management (5)
- Values and Concerns (9)
- Family (11), and
- Institutional (7)
- Only the education trends are listed below:

1. **Expanding education and training throughout society.**

   Increases in federal spending for specialized programs, the knowledge half-life is decreasing requiring constant retraining, more well-paying jobs will required advanced education, schools will train both children and adults, professional alliances between high school and college faculties will grow, and state/local/private agencies will play a greater role in training and adult education.

2. **New technologies will greatly facilitate the training process.**

   Modules will combine computers/video disks/instrumentation to duplicate the work environment, computer models will provide training in alternatives/options, telecommunications will allow course-work to be shared with other school districts or students in another state or country, and education will become more individualized to allow learning according to needs and abilities.

3. **Greater role of business in training and education.**

   The investment of corporations in employee education and retraining is large ($80 billion) and will double by 2001, half of funding for formal training will come from the 200-300 large companies but most new jobs will be generated by small businesses that cannot afford to pay for training.

4. **Education costs will continue to rise.**

   Heavy pressures to control costs will emerge, two-year colleges and associate degrees will grow, and loans rather than grants will constitute the main source of student financial aid.

5. **Educational institutions will be more concerned with ways to assess outcomes and effectiveness of educational programs.**

   Greater emphasis will be placed by the public and the legislatures on the outcomes of public education, faculty/departments will support efforts to assess their classroom/program performance/results and effectiveness.

6. **Improved pedagogy - the science of teaching - will revolutionize learning.**

   Institutions will increasingly apply the growing knowledge about individual cognition to educational situations, the learning environment will not be as important in the future as individuals learn more on their own (places of learning will be more dispersed and the age of initial learning will depend on the individual not tradition), computer supported learning techniques will allow greater material to be learned, and alternative testing approaches will provide better feedback.

7. **Universities will stress development of the whole student and how the university's total environment affects that development.**

Faculty will receive greater support from the administration for class-related activities, and individual students will receive more support from faculty/advisors on decisions about programs and career paths.

8. Reduction in size of higher education institutions.

Private commercial ventures will provide large electronic databases which will eventually replace the university library, students will adopt the "scholarship" mode of learning by consulting books and journals much as professors and graduates students do today, college and university instructors will find employment at secondary schools or business-based educational programs and in producing educational software, and more businesses will conduct research for themselves rather than turning to the universities.

NATIONAL AND REGIONAL ECONOMY

Wharton Econometric Forecasting Associates in their 25-year outlook (February 1988) note that:

- The demographic shift will put a strain on the health care and retirement systems;
- Jobs will be created but the relative size of the young, high-unemployment cohort of the labor force will shrink, causing a decline in "unemployment";
- Federal spending will be slow growth until the deficit is brought under control (about ten years);
- Trade balance will begin to turn positive in late 1990s; and
- The overall economy will grow at an average annual rate of 2.6% during the next 25 years (split about equally between employment and productivity growth). The cyclical scenario estimates a recession in 1990 and 1995.

The 16-member states[19] of the Western Governor's Association (WGA) developed a 1986 report titled "The Western Economy in Transition: Nature, Causes, and Implications." While the characters of the states vary widely, several overall conclusions can be drawn:

- Slowing population growth in most western states is a reflection mainly of greatly reduced in-migration, reflecting an aging population which has become considerably less mobile (Arizona and California had the greatest growth rates);
- The western region is in the midst of a profound transformation and reorientation;
- The prosperity of the western region during the 1970s and early 1980s was due in large part to external forces rather than indigenous economic development;
- The basic industries of the West are declining (agriculture, forestry, minerals); and
- The per capita federal outlays are equal or above the national average.

The WGA long-term outlook concludes that we should

1) rethink economic development (greater focus in internally generated growth than enticing forms from outside the region);

2) recognize the false promise of high technology (jobs are limited, locations few, repeats of "Silicon Valley" are unlikely); and

3) exploit opportunities in the job generation process (economic diversification).

SPECIAL MINORITY ANALYSES

Demographic trends over the next decade and a growing sense of social and political activism among minority citizens of the state could combine to have an important positive or negative impact upon Arizona's universities, as early as the mid-1990s. After the 1990 census is taken, the potential for much greater representation of minorities in the Arizona Legislature is likely to be realized.

Minority leaders in Arizona view education, especially higher education, as their "Key to Empowerment", to quote from the theme of the 1988 Arizona Chicano Conference. Current Hispanic legislators and prominent Hispanic citizens say that there is a perception by Hispanics that the universities are not making the contribution they should to minority education; they also feel that there is a "lack of will or desire" on the part of the universities to implement policies that are already in place. American Indians, because of their lack of success in higher education, should be an area of special concern to the state universities.

Minority legislators, especially Hispanic legislators, will become increasingly important players in the Arizona political arena. They are already wondering if "the universities can reform themselves".

If the universities are responsive to the educational needs of the state's minority population and involve minority communities in the process, the universities will find strong support for the future of higher education; if they are not, there may be increased interest by some minorities in working against the universities.

Two recent reports discuss the minority trends. First, the regional WICHE Minority to Majority Study[20]. This study focused on the five-state Southwestern region (Arizona, California, Colorado, New Mexico, and Texas.

First, the study identified one goal: "Educate for a Multicultural Society." The following recommendations were developed:

1. Recognize the diversity of students, and reflect that diversity in educational policies and practices.

2. Integrate diverse cultural perspectives into the overall educational process.

3. Ensure that all students become fully proficient in the English language while recognizing the value of multilingualism for individuals and society.

4. Expect all students to succeed, and make sure this expectation of success is shared by teachers, administrators, parents, and students themselves.

5. Provide a core curriculum at the elementary and secondary levels that challenges all students and prepares them for the next stages in their eduction.

6. Give top priority to the dropout problem at the elementary and

secondary levels.

7. Involve states more directly in halting the loss of minority students from the educational system.

8. Improve recruitment and selections procedures in the interest of increasing the number of minority students in higher education.

9. Individualize student assessment and student services.

10. Increase retention rates of minority students in college through comprehensive and integrated programs.

11. Coordinate academic programs and provide the support necessary for students to move more easily from high school to college, from two-year to four-year institutions, and from degree completion to employment.

12. Increase the number of minority teachers and ensure that these teachers enter into the leadership of education.

13. Bring more minority students into graduate and professional education.

14. Increase retention in graduate and professional programs by creating an environment that supports minority students and fosters strong faculty-student relationships.

15. Build a network among universities, graduate programs, colleges, schools, professional groups, and business to interest and encourage more minority students to pursue graduate and professional degrees.

16. Pursue vigorously affirmative action goals in faculty hiring, and take other steps to increase the representation of minorities in higher education leadership.

17. Restructure the methods for funding elementary and secondary education to ensure equal educational opportunity.

18. Examine the financial support for higher education and the allocation of that support in light of the economic circumstances and educational needs of minority students.

19. Halt the erosion of student aid, particularly of programs that encourage minority enrollments, and promote financial planning for college education.

20. Examine loan programs in terms of their effects on students' educational decisions and on the achievement of society's goals for education.

Second, the Department of Economic Security released a study titled "Hispanics in Transition" in 1986.[21]

The highlights include:

1. Arizona is fourth in percentage of Hispanics in the United States (NM=36.6%, TX=21.0%, CA=19.2%, AZ=16.2%, CO=11.8, NY=9.5, FL=8.8, IL=5.6); overall US=6.4%.

2. Arizona counties with the most hispanics are: Santa Cruz, Greenlee, then Yuma, then Pima, Pinal, Gila, Cochise, Graham, then La Paz and Maricopa.

3. Graduation improvements were significant between 1977 and 1981 in BS/MA (26.5%) and PhD (33.3%) degrees for Hispanics but their were significant decreases in AA (-2.7%) and MS/MA (-4.3%) for an overall gain of 7.4%

4. The major education problem for hispanics is the high drop out rate for high school: 19.7% hispanics vs 14.5% for total students for FY 85.

5. Hispanic enrollment for FY 85 was 17-18 percent for grades 9-12 and 22-25 percent for K-6.

6. More Hispanics (71%) have children compared to families of all races (50%) using U.S. 1980 Census data.

7. Age distribution for Total Arizona population has a "bulge" from the 15-19 age group through the 30-34 age group; but for hispanics it is the 0-4 age group through the 25-19 age group.

8. Using 1986 population estimates, about 51% of hispanics are less than 22 years old, and 33% are less than 14 years old. Hispanics account for about 25% of the births in Arizona (years 1980-1984).

HIGHER EDUCATION CRITIQUES

There have been a number of recent "assessments" of higher education. A separate paper lists detailed reviews of 13 of these[22]; a few highlights include:

The value of an undergraduate degree has declined; the curriculum needs restructuring; universities should be more accountable and develop assessment tools; there is a discontinuity between schools and higher education; faculty have divided loyalties (among research and teaching) and institutional confusion on purpose; universities and communities or the larger world need to increase communications; community concern for quality of education; universities should improve participation rates of all groups; and provide a range of opportunities for a changing work force and society.

MANAGEMENT AND ORGANIZATIONAL CHANGES

While there are a number of studies relating to the response by management to some of these anticipated changes, two reports will suffice to summarize the leading thought on the subject.[23]

First, Donald Michael reports:

"Most organizational cultures are drastically unfit for meeting the challenges confronting them as they move toward the 21st century, especially organizations such as universities that must operate at high levels of uncertainty. To cope constructively, the university culture must perform as a learning organization, continuously asking the questions: Where do we want to go? How do we get there? Are we getting there?

The broadest overriding observation about the societal context is that the dominant myth systems are facing multiple challenges, and growing amounts of information are increasing these uncertainties. The contentious and information-rich societal context is certain to confront the university with multiple claims regarding priorities, services, opportunities, and claimant legitimacy.

The new competence for performing resiliently in the turbulent environment has five attributes:

- The ability to live with and acknowledge high degrees of uncertainty;
- Embracing error: discovering what is not going as anticipated; and using these discoveries to learn, revise, and experiment anew;
- Being future-responsive: considering multiple futures and their consequences, to confront us with the ethical issues abiding in what we aspire to and what we avoid;
- The ability to span information and normative boundaries;
- Interpersonal competence: the ability to listen, support and empower others, and cope with value conflicts."

Second, to give an example of how a conceptual change might occur in organizations, Peter Drucker has suggested two models of the organization of the future. These are based on information and knowledge patterns: the symphony or the hospital, because of reduced layers of management and increased need for "task-based" team approaches to problem solving. In the first example, there are few leaders and the players are all equals in the structure but each performs a specialized role. In the second example, tasks are identified that draw specialists from various disciplinary areas for the particular medical task at hand, then the specialists regroup in a different manner for a different task. With today's information technology, both of these models become possible.

ARIZONA STUDIES AND SOURCES

Arizona Academy Town Hall Meetings[24]

The 1500 member Arizona Academy is composed of a cross section of Arizona (mostly opinion leaders) citizens and for 25 years has been holding semi-annual meetings on topics of broad interest to the membership (identified by annual survey). This group is of special significance to the universities, since each meeting is preceded by a report on the subject, which is developed by one or more of the Arizona universities.

Reports and their subjects from 1983 to 1988 include:

Post-Secondary Education

Responsibilities of News Media

Health Care Costs

County Government

Growth Management and Land Use Planning

Managing Water Quality

Social Services

Arizona's Changing Economy

Culture and Values

Arizona's Relations with Mexico

Air Quality

Civil Justice System

Results of Questionnaire mailed to membership in January 1988, requesting top three issues of concern (open ended question, numbers indicate tally of

responses).

Education (K-12): 663

Mental Health (including homeless): 423

Rural/Urban interests (competitiveness): 379

Arizona Water Future: 357

Growth and Long Range Planning: 322

Responsive State Government: 291

Arizona Sense of Community: 256

Health Care (particularly long term): 236

Arizona National Posture: 230

Transportation and Highways: 214

Youth and Families: 209

Tax Structure: 201

Arizona Indian Population: 156

Arizona Senior Adults: 155

Preservation of Natural Resources: 140

Substance Abuse: 122

Public and Private Partnerships: 101

(eight other items with less than 100 responses each)

TECHNOLOGY AND ECONOMIC DEVELOPMENT

The 1983 Arizona Governor's Conference on Technology and Economic Development identified six areas that are closely related to university future activities in this area:

- Establish Centers of Excellence in state's universities for high technology activities
- Develop a long-term state telecommunications policy
- Review ABOR patent and sponsored research policies
- Explore formal mechanisms to promote technology transfer (from universities to businesses in state)
- Set up a Council on Science and Technology
- Increase research funding support

URBAN GROWTH IN ARIZONA:

A POLICY ANALYSIS[25]

This 336 page report was available in draft form (July 1988) for reference in this working paper. The chapter "Some Alternative Futures for Arizona" includes four scenarios. These are:

A "SURPRISE FREE" SCENARIO

Assumes generally that present trends continue. Growth would be concentrated in the two metropolitan areas, raising issues of population concentration, intergovernmental cooperation, and environmental degradation. Anticipates population growth to gain about 60 percent by the year 2000, with relatively rapid growth which fluctuates according to economic cycles.

POST-INDUSTRIAL ARIZONA:

THE INFORMATION AND LEISURE SOCIETY

Emphasizes the service economy. Increased leisure time, greater rises and falls of population due to travel and part-time residents, with growth of mid-sized cities outside the two major metropolitan centers. Suggests growth will become less important as we approach the next century and the states evolution is driven by technology rather than population.

THE SLOW-GROWTH SCENARIO

The "state religion" for growth could change based on revitalization of the rust belt so it no longer serves as a major source of migration over the last two decades; this is bolstered by a weak dollar that gives manufacturing a new life and the midwestern economy improves at the expense of the southwest, causing a reverse migration.

Faced with dramatically slower population growth, the Arizona of the future would be very different; it would be inconsistent with the state ethos and investments in the social infrastructure would be heavily needed at a time when the tax base was shrinking.

A COMPREHENSIVE STATE POLICY ON URBAN GROWTH

A view of the future looking back on the present finds the need for an "Arizona Growth Management Act." The Act was developed as a result of the growing perception that something had to be done to manage population growth on a statewide basis.
In addition, there are some "surprises along the way." There are six "unexpected" events worthy of discussion:

1. Mexican Revitalization or Revolution (two extreme options).
2. High Speed, Levitated Trains (very rapid long distance transit).
3. New Developments in Health Care (extended lifespans).
4. Urban Arizona As a Cultural Mecca (two metropolitan centers).
5. Computer Networking (electronic communication).
6. The End of Geography (broad regional development).

RECENT SYMPOSIA AND PUBLIC MEDIA[24]

The Arizona Department of Transportation held an "Arizona Futures Symposium" in October 1987. The purpose was develop a greater understanding of the next 25 years in relation to demographic, socioeconomic, and technological changes related to transportation planning. The overall "flavor" of the symposium was to recognize that prediction is difficult, there could be significant perturbations in several of the trends, and we should learn more about learning about the future (range of possibilities and positive and negative consequences).

The Arizona Republic developed a special insert for its April 17, 1988, editions. The summary statement indicated:

"Many forces that will shape Arizona's future are beyond the control of its people. International, national and regional forces will surely influence events to a considerable extent. But much of what happens here is up to

Arizonans. What crucial choices will they make on the critical issues of the next quarter century? What kind of educational system will Arizonans pay for? How much health care will they be willing to finance? What means will they use to provide transportation? Will they demand effective leadership - and assist that leadership with meaningful citizen participation - to solve state and community problems? How will Arizonans maintain the quality of life that attracted them, when the population of the state doubles in the next 25 years?

What kinds of limitations will they place on growth, water usage and air pollution? The first century of life in Arizona was spent inventing a way of life. In the next century, the tough part comes as the state's people choose how they wish to respond to the myriad challenges they face. Past choices have, in part, created today's issues and crises."

UNIVERSITY AND EDUCATION RELATED STUDIES

A 1988 study was funded by the Task Force to look at population, economy and jobs, public education, and university trends.[27] The detailed summary of this study is listed in Part II of this report.

A 1988 study was completed for the College of Education at Arizona State University "Arizona: The State and Its Educational System[28]." The conclusions include:

1. DISTRIBUTION

Increasing problems concern low-income people traveling long distances to work in high income communities to which they can never belong.

2. SMALL BUSINESS

The decline in the middle of the Arizona work force is real, with increasing numbers of jobs on the high and low income sides. The state needs to do much more in the development of minority middle classes.

3. YOUTH AND POVERTY

More youth entering school will be "at risk" which could result in even further reductions in the numbers of young people who graduate from high school. If this happens, <u>everyone's interests in Arizona</u> will be affected negatively (emphasis in original).

4. HIGHER EDUCATION

Higher eduction needs to be articulated with the public schools. Higher education in Arizona can be no better than Arizona's schools; at the moment, Arizona's business leaders seem to have a better understanding of this obvious fact than some of the professorate.

5. SCHOOL POPULATIONS

The schools and the legislature need a <u>youth policy</u> that can guide action in the area of class size (to prevent increases) and funding per student (to prevent declines); this is particularly important in a state with an increasing percentage of youth who come from non-Anglo backgrounds.

NATIONAL FRESHMAN SURVEY RESULTS

For 22 years, the American Council on Education and the University of California, Los Angeles, have conducted annual surveys for the Cooperative Institutional Research Program (CIRP).

The 1987 annual freshman survey report lists viewpoints of 290,000 freshmen in 562 colleges and universities.[29] Among the changes observed over the last 20 years are:

1) a recent resurgence in interest in teaching careers,

2) a sharp decline in interest in health careers (e.g., nursing) among women,

3) a leveling in interest in engineering careers but a continued upswing in business careers (primarily management and only among men, with a decline in interest by women in business),

4) a sharp decline in interest in computing careers after a sharp increase,

5) a slight shift of political preferences from conservative to liberal (reversing an 11 year trend) along with a decline in the middle-of-the-road preferences (the crossover occurred during the period 1981-1984), and

6) a continued interest to be very well off financially compared to developing a meaningful philosophy of life (these trends crossed in 1977).

While not listed in the CIRP surveys, there has been a resurgence in interest in courses relating to 1960s interests and student activism.[30] A summary of selected trends is in Figure 1.

Figure 1. CIRP 1987 Survey Trends.

ARIZONA BOARD OF REGENTS STUDIES

ACADEMIC AFFAIRS COUNCIL

The Board of Regents is organized into several Councils, which include the Academic Affairs Council. This Council developed as series of external and internal driving forces for academic planning guidance (draft completed in May 1986).

External Driving Forces

DEMOGRAPHIC

- Population will continue to grow.
- Traditional age students will increase in mid 1990s.
- Minorities will increase.
- Urban growth will be coupled with rural decline.

SOCIAL AND POLITICAL

- Public expectations concerning equality of opportunity will remain high (higher education a right).
- Life style will demand extensive services.
- Public concern for certain risks and for certain moral and ethical issues will grow.
- Awareness of global interdependence will increase.

TECHNOLOGICAL

- Technological changes will lead to emergence of new occupations and disappearance of old ones.

- Rapidity of technological change will result in multiple careers during a life time.
- New technology will change modes of communication and information storage.

ECONOMIC

- Economic growth will allow room for expansion but in unpredictable spurts and in stiff competition.
- State and private funding may replace federal to some extent.
- Economic growth will require strong Research and Development in Arizona.

CULTURAL

- Demand for "cultural services" will grow.
- Ethnic groups will continue to demand recognition for their cultural traditions.

Internal Driving Forces

DEVELOPMENT OF KNOWLEDGE

- Disciplines will expand and contract.
- New disciplines will emerge from interdisciplinary efforts.

DISSEMINATION OF KNOWLEDGE

- New modes of instruction will emerge.
- New modes will be less campus-bound.

RESOURCE DEVELOPMENT

- Resource development (new sources) and reallocation of resources will become even more important as program needs multiply and traditional resources remain limited.
- Certain sources will be even more closely tied to specific uses.

MANAGEMENT AND ADMINISTRATION

- Independence of universities/ academic freedom will need continued protection as demands multiply.
- Demand for accountability in resource allocation will continue.
- Planning efforts will require broad participation from inside and outside the universities.
- Flexibility will be very important in dealing with rapid change and uncertainty.
- Faculty retirements/pressures from other employers will require careful manpower planning.

FUTURE NEEDS OF THE STATE COMMITTEES[31]

The Board of Regents in 1985 appointed a Future Needs of the State Work Group as part of the strategic planning activities. The results of the three committees are summarized here.

ECONOMIC, DEMOGRAPHIC AND MANPOWER COMMITTEE

Population flows and Arizona employment are influenced by the

business cycle; slowing during recessions and expanding during economic growth periods. The prevailing view is the "Arizona population will swell by 1 to 1.5 million people between 1985 and 2000, with the number of 18-year olds increasing from 45,000 to 71,000 (55% increase)." The Arizona economy is changing, with agriculture, mining, construction, and government are declining in importance; the most rapid growth has been in manufacturing and finance, insurance, and real estate. The relatively balanced growth across job classifications is not expected to continue, with manufacturing growing modestly and service growing more rapidly. Several specific projections are made:

- Population will continue to grow in Arizona at an average rate of three percent from 1985 to 2000, bringing 100,000 new citizens per year to the state.

- Nationally, the number of college aged students is projected to decline until the late 1990s when the "baby boom echo" (children of baby boomers now 20-40 years of age) is felt, but in Arizona the number of college age students will continue to accelerate from the present to the year 2000.

- Contrary to popular belief, the population of Arizona differs from that of the nation not in the number of elderly, but in the large number of younger cohorts 5-19 and 25-29. By the year 2000, Arizona will have a higher percentage of 18 years olds than the nation.

- During the next 15 years, the fastest growing age groups in Arizona will be the 35-54 age group and the 9-19 age group. This latter group - the baby boom echo - will begin to reach college age in large numbers by the year 2000.

- More than one-third of the Arizona population under 25 are minorities. Nearly 40 percent of those under age 10 are from minority groups. During the next 15 years those cohorts with progressively higher minority representation will enter the traditional college ages.

- Modifying this strong trend in ethnic mix of the young will be the effects of in-migrants, 90 percent of whom are non-minority. Most in-migrants come from California, Illinois, New York, Colorado, New Jersey, and Michigan.

- Of the 15 fastest growing job categories requiring college training, all but two require schooling in either business, engineering, health sciences, or education.

- Because we live in a dynamic state driven by a market economy, there may be rapid changes in employment conditions for special occupational groups. Therefore, flexibility in courses of study and areas of emphasis should be encouraged and facilitated.

EDUCATION AND PUBLIC EXPECTATIONS COMMITTEE

The committee identified five trends, with the indicators, related public expectations and the emerging issues for each. The trends and indicators are:

1. Heightened concern about undergraduate program quality

Declining level of preparation of entering students; push for higher standards for admission, retention, and graduation; three national reports (NIE, NEH, AAC) decry the condition of undergraduate education; major institutional efforts launched to reform the under-graduate curriculum.

2. Widespread concerns about the faculty

   An aging, tenured-in, and increasing immobile professorate; reduced faculty morale and vitality; an impending shortage of high caliber faculty and a shortage of minority faculty.

3. Concern about student access and retention

   Declining college participation and high attrition rates among some minority groups; nationally, a shrinking pool of 18 to 22-year-olds and a sharp increase in the 35 to 54 and over 65 age groups; a substantial increase in the proportion of the population made up of historically under-prepared minority groups (Blacks, Hispanics, and American Indians), including recent immigrants.

4. Increased emphasis on assessment

   Widespread use of program reviews; growth of student testing and assessment.

5. National concerns about legislative and executive groups establishing university policy

   Increased legislative and executive group intervention.

The committee also developed enrollment projections for the universities to the year 2000. The committee concluded Arizona universities enrollment may increase 46 percent (30,000 students) by 2000, with the greatest increases occurring in the years 1995-2000; the smallest increase is expected between 1985 and 1990, with a 7.9 percent increase (5,200 students). Non-resident enrollment was projected to increase 25 percent (3,996 students) by 2000. The basic projection model was the same for all Arizona universities and used Department of Economic Security growth estimates. The specific assumptions differed by campus, because often enrollments are determined by university policy and managerial actions.

GOVERNMENT, BUDGETARY AND NATURAL RESOURCE CONSIDERATIONS

Arizona's traditional conservatism is notable for strong support of higher education. Demand in per capita enrollment is high, and spending levels also rank above the national mean. The environment for the future may not be so favorable. Federal funding cutbacks shift burdens to state and local governments.

Competition for state appropriations will increase as federal support declines. There is a high degree of competition among the universities which is pursued through regional alliances in the legislature. The universities have distinct qualities, including varying stages of maturity as measured by graduate and research programs. These differences require differing responses in policy and state support.

Factors affecting the future policy environment include a dual demand

pattern from the baby-boom "echo" and from adults. Much of the "echo" generation may choose community colleges as entries into higher education. Enrollments of women and ethic minorities will increase. Demand for graduate education may also increase more rapidly than undergraduate enrollments. Most major legislative accomplishments are built on cross-party coalitions, although the general conservative posture is likely to continue.

The state government will face major expenditure demands for crime and corrections, health care, water development and pollution control, transportation, and other needs of a growing state as well as education. The universities may respond to perceptions of scarce state dollars with more intense competition. An option would be a conscious alliance among the three universities to present a united front on behalf of quality higher education.

Precision in estimates of financial resources available for higher education is impossible; all key factors are volatile.

The federal funding outlook is clearly not generally optimistic, but not uniformly dark. Relatively more of both federal and corporate funds are tied to specific objectives. Gramm-Rudman will cause further immediate cutbacks; tax law changes and federal research priorities (including the fate of the "star wars" initiative) will also be critical factors. State sources provide more than half of university revenues in Arizona.

Scarcities of developable land and of water are persistent concerns of many Arizonans; these fears are not well grounded. Areas of the state most likely to grow most rapidly are shown to be sparsely developed relative to metropolitan areas of similar size, with ample land for expansion for decades to come. Water scarcity concerns arise from projections which do not include declines in present rates of agricultural water consumption (now between 80 and 90 percent of total). First generation water plans for critical water supply regions in the state demonstrate that water supplies and uses can be balanced by 2025 with reasonable conservation measures for all uses and for reductions in acreage of irrigated agriculture.

Environmental protection is critical to maintain the usability of scarce water resources; a strong groundwater protection program seems likely to emerge in the short-range future.

Amenity values are important to location of preferred industries such as new firms and corporate headquarters relocations in Arizona. Given federal floors on environmental standards, Arizona risks little in visible commitment to environmental quality, especially in groundwater quality protection. The attractiveness of Arizona's landscape is most important as a factor in quality of life for Arizona residents. The public demand for protecting and enhancing environmental values while accommodating a growing population offers opportunities for national university leadership in research and instruction with respect to arid land environments and resources.

TASK FORCE INTERVIEWS

Representatives of the Task Force staff interviewed all university vice presidents, six faculty groups, corporate and banking planning representatives, and had a group discussion with an external advisory committee and futures studies

consultant. The issues raised relate to:

UNIVERSITY AFFILIATES

These comments were summarized from meetings with university vice presidents, selected Board of Regent's Associate Directors, and six faculty focus groups.

DEMOGRAPHICS

- Good probability the AZ population growth will continue. Water is not the problem once was (can shift from agriculture) but is a problem in Flagstaff.

- There is still a lot of industry wanting in to the state.

- AZ is growing, like an annex of southern CA. The environment for economy/social attitudes becoming more like Southern CA and dropping old cattle, copper, citrus, cotton.

- Maricopa county may reach its practical growth limits sooner that we think (transportation constraints, air quality); this may cause more growth in major urban areas not located in Tucson or Phoenix metropolitan areas.The 1990s will bring a dearth of students as the 1993 high school graduating class will be the smallest for years, but the growth will be rapid again by 2000.

ECONOMY

- Traditional jobs and activities vs new jobs (by 2000 probably 50% of the jobs do not have job descriptions written). So must plan for unknown in training people.

- Wild scenarios: depression/economic concerns (including COLAS for social security and deficit reduction needs).

- Some companies will not locate to AZ unless there are good schools at all levels.

- Should expect a downturn in the economy in next 3-5 yrs. Phoenix will expand again in the mid 1990s (with a significant burst of growth). Growth may be 3-4% in mid/late 1990s. We have the raw materials for this growth.

- Service and high technology economy will be the dual economies. Will have low wage and high wage, so a bimodal economy (limited "middle class"), and it is already getting to be like this. This is a strategic issues: the role of the university in a dual economy like this.

- Economic downturns may be perturbations rather than big trends, so recoveries are likely to follow downturns on within a short time.

- The economic base gets bigger so the system growth rate goes down.

- We will not see major perturbations in the job market in the near future; the service sector will continue as a major employer through the year 2000.

- Dangers signals for youth include lagging interest in high quality. There are a lot of economic incentives to quit school early.

TECHNOLOGY

- We will radically restructure knowledge. The two big ones (major revolutions) are telecommunications

and biologic (biotechnology).

- Knowledge Industries are coming so universities will change profoundly as it is a natural institution for the subject.

- Revolution in biology here and coming. Like quantum mechanics in the 1920s, major changes for years and pervasive. Hard to fully comprehend the full impacts.

- Telecommunications, data, and artificial intelligence will remove the drudgery of some courses and really allow learning to take place. This will have a profound impact, equivalent to the renaissance or industrial revolution. With the dispersed population in much of Arizona this may have particular importance in the state.

- Space exploration has had an impact on the economy and on university research in the past, but these activities are likely to be flat for several years.

SOCIAL

- The United States is rapidly becoming an hispanic society, and unlike other ethnic groups before them, the hispanics will not be assimilated into the American society simply because opportunities of the past no longer exist. We need to understand this and work toward a hispanic culture and define its role.

- Universities will have different audiences (not all 18 yr old high school students or 20 yr old community college transfers coming in but come from all directions and ages). Single parents (needing day care), older women and retired people coming back. Will be lot of diversity. Long term recruitment/retention will have a lot of transition periods. This will involve different ways of teaching, living arrangements, lifestyles. Some federal mandates will cause a demand for programs or disciplines we should train for.

- Access and retention for minorities will be a major issue. The WICHE study raised profound issues.

- A lot of things will impact the personnel (students and employees) in the universities: single parents with all the special needs they have, all women in the workforce, split tasks (two half time people for one full time job), full time as 3/4 time for some.

- Future emphasis may be on transmitting information and disseminating language. Academics don't do that well and we need to integrate or translate information for now-academics.

- Higher education is becoming more important in the world - for society's research capacity and competitive needs. Society is complex and need education to understand how to participate.

- Demographics are such that minorities will be an increasing portion of the population, this will impact on "culture". How do we serve this different population, since it is different in character in than the past.

- The "yuppie" values are declining and there is more interest in social programs; this will affect university

curricula.

- Structure of the work place is changing so those in mid-career can no longer move up the traditional career ladder.Society will confront a lot of new environmental issues and the university will have a large role (e.g., air and water quality, water resource management).

POLITICAL

- Future of Mexico is mixed with the uncertainties of current democracy (moving to socialist/communist) and the economy; this will cause a lot of border tensions.

- We are becoming more involved with international relations, and the resulting need for more effort in university curricula in languages, international studies, student exchange programs.

- We can be more optimistic than even five years ago that the U.S. political and economic system will not change significantly. There will be more governmental regulation as a result of recent abuses (e.g., stock market).

HIGHER EDUCATION

- Many minorities and women are overworked on committees to give "racial and sex" balance.

  What are the universities missions today? The universities need to better integrate themselves into the communities they serve. Every campus cannot do all activities well. Faculty outlooks are different as the purpose of the campus differs.

- The universities or the Regents do not have a clear vision or sense of mission that is understood by all. In developing strategic plans, the universities must remember to involve external stakeholders.

- The Arizona universities can no longer plan on a growth in budgets every year, year after year. We will have to take another look at and rethink our priorities.

- What kind of students will we see in 10-15 years.

- There will be industries trying to educate their own employees and we should cooperate not compete (use cooperative education or make special programs to teach for the industry).

- Arizona needs to put more emphasis on elementary and secondary education. University students coming out of Arizona high schools are not well prepared for college.

- Significantly higher tuition rates are coming. Capital needs - how will we meet them. In the world of computers it is expensive to renovate laboratories and provide new equipment.

- Responsibilities of bearing the cost of higher education have shifted from parent to student, with the student taking out more and more loans.

- How do we maintain access when we raise standards. Costs will move from 20% of cost of education to 25% (tuition) - we need more analysis of this.

- Employers will have to take more responsibility for educating their employees. This is especially true with current functional illiterates. The university will have to help train with additional education by new methods.

- The concept of Cooperative Extension Service is good - technology transfer and moving university results to users. The audiences have changes, however, and are not small ranchers-farmers-homemakers but small business. Universities will have to consider new audiences, in addition to on-campus students or only offering courses as a means of information transfer.

- Need to rethink how university learning is put into usable and practical information for many people.

- There are physical constraints to getting too big. But the risk of rising admission standards and enrollment caps may cause the "elite" view to suggest the universities are not for the average person.

- Where there is a perceived elitist attitude in universities and the community colleges as the only other higher education option, then you should expect high university drop out rates.

- Student retention is more important than just admission. For first generation university students (parents did not go to college) the first year is critical. If attention is not paid there, we will loose the first generation person and not gain them back.

- The curriculum will have to be overhauled more rapidly in future. Faculty will have to be more involved with the knowledge base of univ.

- Three big issues for future and universities: 1) external demands and attendant new fields, 2) subjects themselves change (like biology), and 3) information technology and tools available to disciplines.

- Dangers signals for youth include lagging interest in high quality. There are a lot of economic incentives to quit school early.

- Danger of too much academic specialization toward technology; there needs to be broad questions/approaches raised for undergraduates.

- Where will university growth stop? How many facilities can we expect to build? How big should a campus be? How many branch campuses should there be? There are differences in main campuses and branch campuses.

- To what extent do we expect to develop branch campuses like ASU West? Do we duplicate another in Tucson? Sierra Vista/Yuma, what are demands of other counties? What requirements are there for the counties to support?

- In many instances people have over-built colleges and universities, but the communities have sufficient political clout that the campus cannot be removed when no longer productive/efficient.

- We might find a revival of the "medieval university" which was mobil, moving from town to town (for rural areas).

CORPORATE AND CITIZEN AFFILIATED

These comments were developed by a meeting of the special Task Force Staff Advisory Committee and selected interviews with corporate, business, and civic leaders.

DEMOGRAPHIC

- Slower population growth rates expected for Arizona
- Increased minority involvement as a percentage of the population

ECONOMIC

- Sustainable economic development is a priority
- Internationalization and world economy/local economy linked to US
- Standard of living steady to decline in US
- Economic depression possibility; if the economy goes down, the "potential" entrepreneurs within companies may move out and start their own companies
- The movement to service economy/high technology will grow but not as fast as service; there is more in health employment than in computers and electronics
- New jobs have largely been small business/entrepreneurial (applied innovation)
- New taxes expected; energy tax, value added tax to fix Reaganomics; likely not cut education
- Arizona orientation might be: pacific rim (PAC-10 type universities), mexamerica, rocky mountains
- Multiple transformations, multiple changes underway and coming (and at different rates)
- Minorities and women will increase percentage of work force and higher skilled jobs

TECHNOLOGICAL

- Science and technology: high technology and high touch (special skills), biological, materials, information, energy, computers and robots
- Life span extension/who gets the increase/retrain folks more for multiple jobs in a career
- New knowledge systems will have major impacts on how society functions
- Robotics will have an impact on a segment of population
- Example of simple but very important impact of technology is air conditioning and Arizona.

SOCIAL

- Breakdown in morality, inadequate education, north-south gap
- Nuclearannihilation/weapons/peace

- New energy crisis likely
- Human rights revolution underway
- Values changes: attitudes-expectations-quality-feminization- expressivism-spirituality-self help are gaining in interest
- Human uncertainty: multiple options/differentiation (status, respect, power)
- Growth in knowledge with increases in technology; impacts not clear
- Mobility/decentralization of workers and others
- Long term planning becoming more necessary
- More activism at several societal groups
- Infoglut and dealing with large amounts of information
- World is getting smaller and university is recognizing it more study abroad programs
- Future of winter cities, focus on humans not structures so create new places (or refurbish old places) that people need
- New renaissance period may be coming; we can shorten time by communications, and increase breadth, but the potential for chaos is greater between the new and old, fundamental shifts on how people perceive reality; renaissance is greatest when lot of people can participate meaninglyfully in change during same period. Maybe we are getting the technological capability to do just that on a very large scale.
- The dominate need for community is still there; less for jobs and family folks but more for independent folks. There is a need for belonging, can no longer trust employer to "take care of you." Higher education might become a cornerstone of community due to its multi-functional abilities to gather people together.
- Community definition is changing, was more materialism oriented when saw others had something but the standard of living was getting less and may not be as important. People were busy on non social programs but that may be changing; more early idealism coming back toward community focused efforts (but may not be traditional community)
- Middle age folks raised in 60s have not lost idealism now kids are gone and career is satisfactory so can do something for others
- High or well paid executives are in middle age (40-50's), but the coming executives (30-40's have more people to compete with and less opportunity to move into historic positions (downsizing management); this may cause conflicts and pressures.
- Must cooperate more and be less competitive, conflict resolution needs better understanding. Again, competition vs community is an issue.
- Computer standards might be models for cooperative/competitive activities. If you don't have some "common" standard everyone has too little market to survive, but a few

standards allows group efforts but with individual contributions.

- Need cultural diversity in Arizona. The Native Americans and Hispanics will become more important over time.
- Lot of prison construction/crime in AZ. Why is this?
- Experts can look at issues through their narrow focus, but need mechanisms to have things come together for better understanding.
- Can begin to identify new fields by futures oriented looking. A recent example might be cognitive science (linguistics, neuroscience, physiology)
- Need incentives to look long term, universities are like corporations and look short term
- Involvement of people and greater support for them will be more likely in businesses in the future
- Need for increased flexibility in benefits, working conditions for employees (e.g., non-financial rewards)
- Workers wish more autonomy, participatory decision making, communication and feedback, involvement in the institutional culture and sense of belonging
- Acts of god and man must be considered in future scenarios
- Lot of information exchanged informally through networks; we need to keep this in mind.
- Certain ideas currently in power: excellence, competitiveness (e.g., ideas held by those in power)
- A big problem for society is the number of high school drop outs. If they cannot read then we are in trouble and there will be significant social costs to all.

POLITICAL

- Networking and participatory democracy are increasing in interest
- Increases in terrorism (including chemical and biological weapons)
- With new information technologies one can achieve global interactions without leaving the homebase
- Increase in regulations: pollution control, waste management, traffic movement, medicine and drugs/substance abuse.
- Revival of peace corps/vista, national voluntary services.
- Learn to deal with macro emergency responses (e.g., major FL hurricanes, CA earthquakes)
- We should plan for a major disaster; most universities shy away from this in their planning activities.
- Some hopes: better Soviet/US relations, corporate renewal, biotechnology, information technology, new thinking
- Some fears: economic collapse, environment, nuclear weapons, AIDS, third energy crisis

HEALTH AND ENVIRONMENT

- Overpopulation, environmental degradation, natural resources/baby boom, migration, north/south, sunbelt/south
- Critical environmental needs/ population needs, waste disposal, climate warming, water quality

HIGHER EDUCATION

- Universities should look at what areas are not being done (e.g, follow-ups on biotechnology and its impacts on other disciplines)
- Need to educate for "corporate" entrepreneurs. Most business school case studies are based on large or medium corporations but that is not where the action is today
- Why do me keep producing more MBA's when we need fewer middle managers (is it simply due to student demand? Do we just need a new definition of the MBA?)
- Implications for higher education: more learning styles possible by choice, more electives, new communication patterns, new degree types
- We should foster integrative thinking
- We should exploit southwest futures
- Work/education at home: discussion on new communication patterns was a lot of wishful thinking by Alvin Toffler. But, we need community; teaching at distance has lot of potential but remember not all people will be working at home.
- Mexico is close, we should consider many more interactions with Mexico than just on economic issues
- More futures research is needed about things that could happen; the times are uncertain and we need to keep our eyes open.
- We will get educational competition from other states if don't do something on telecommunication and educations. State borders are non-existent with satellites.
- Changing jobs and technology shifts will require continued training of the workforce
- Why is the University of Phoenix a competitor? They are aggressive, give what the customers want in the way of an education, and they are flexible; universities are too rigid (both in accommodating students and providing offerings).
- Universities are not generally environmentally sensitive and cannot respond rapidly to change; sometimes this is good and sometimes it is bad.
- The universities need to have a few areas of excellence not a ton
- UA/ASU want international/national research reputation; NAU and Grand Canyon college teaching. Not sure this is bad.
- What is good for society ? Are the univ addressing the right areas? What are the right areas? What should a modern university be doing for society?

- Are policy and technical oriented political think tanks replacing universities in providing intellectual debates? Probably yes, the think tanks fill vacuum; universities base their rewards by discipline and problems are interdisciplinary). Universities need to make a place for horizontal understanding not just vertical investigation.

DEMOGRAPHIC CHANGES

The United States population is undergoing a dramatic change as the "baby boom" children move into the middle age brackets and their children (echo) become college-age in the next decade (Figure 2). These shifts account for a declining 18-year old population during the next few years and the resurgence in the next decade, the increase in post 65-year olds, and the significant shifts in the mid years.

INTERSTATE MOBILITY 1975-1980[32]

The age distribution and the migration rate is an important variable for Arizona population estimates. Table 1 indicates the age distribution and greatest mobility.

Table 1. Age-Specific Mobility of U.S. Population*

Age Group	Population	Interstate Movers	Migration Rate
5-19 Years	16,575	1,857	112
10-14	10,101	1,588	87
15-19	21,020	1,951	93
20-24	21,208	3,282	155
25-29	19,516	3,308	170
30-34	17,705	2,439	138
35-39	13,944	1,508	108
40-44	11,626	951	82
45-49	11,053	683	62
50-54	11,741	583	50

*US Bureau of Census, Population in 1000, Rate in movers/1000 population

The age groups from 20-34 represent the highest migration years. The largest percentage of the population in those age brackets occurred in the 1970-80 timeframe, with some trailing 5 years on either side (Table 2); thus, migration estimates developed during this high period are unlikely to prevail over the next decade or so.

Table 2. Changes in Age Composition of U.S Population 1965-1985*

Age Group	1965-70	1970-75	1977-80	1980-85
Under 5	-13.4	-6.1	2.1	9.5
5-9	- 2.3	-11.7	-5.6	1.3
10-14	9.5	- 1.0	-11.6	-6.2
15-19	13.6	10.4	- 0.6	-12.1
20-24	23.7	16.5	10.7	- 1.8
25-29	21.2	26.3	14.6	10.5
30-34	4.2	22.8	25.6	14.2
35-39	- 7.3	4.6	21.5	25.8
40-44	- 3.5	- 6.6	4.9	19.9
45-49	6.8	- 3.0	-6.2	5.4

*U.S. Census Bureau, numbers in percent.

HIGH SCHOOL GRADUATION RATES (WICHE) 1986-2004

The Western Interstate Commission on Higher Education recently updated their Projections of High School Graduates to the year 2004.[33] The future trends in high school graduation will dip in the 1989-1994 period and increase beyond 1994.

However, the growth rates will differ markedly by state. For the period 1986 to 1992, the only states with a positive growth rate are Alaska, Arizona, Nevada, Utah, Florida, Georgia, Tennessee, and Texas. States with a negative growth rate from 1986 to 2004 include Illinois, Indiana, Iowa, Ohio, Wisconsin, Idaho, Montana, Oregon, and Wyoming.

While high school graduation rates are not predictors of university enrollments, that age group currently accounts for over 85 percent of the enrollment in the

Arizona universities. Future enrollment changes can be dramatic, depending on how the universities react to these demographic changes, the number of part time students, the admission standards, and the economy. The comparison of Arizona to United States projected graduates is shown in Figure 3, at the end of this section.

ARIZONA ENVIRONMENTAL SCAN[34]

The following summary is taken from Bartram and Gebel, Arizona Environmental Scan Study.

I. DEMOGRAPHIC CHANGES

- Year 2000 Arizona population estimates vary from 4.618 million (US BEA) to 5.321 million (AZ DES), a difference of 703,000 over the next 12 years. The DES year 2010 estimate is 6.686 million and the BEA estimate is 5.319 million, a difference of 1.367 million over the next 22 years. The 1987 population was 3.480 million. The DES number is generally acknowledged to be high, and the BEA is using a revised method involving interstate migration rate data.

- Changes in population age groups are due to 1) the baby boom moving into the middle years, 2) increased longevity, and 3) increased young as a baby boom echo. Peaks occur in the 0-4, 24-39, and 64-74 age groups. The age distribution of Arizona is very similar to that of the United States, with slightly higher numbers of children less than 14 and persons over 65.

- Net migration to Arizona is the primary cause of growth but there is a large out migration rate as well as the large in migration rate. During the five-year period 1980 to 1985, in-migration averaged 161,200 and out-migration averaged 116,380, for a net growth of 44,820. The ration of in- to out-migration is about 4 to 3. In-migration is related to the economy and has ranged from less than 40,000 to over 90,000 in the last 15 years. In-migrants are more likely to be young adults, with income, more education, and white.

- The top migration flows for Arizona (and whether the net flow to Arizona is increasing or decreasing over last 5 years) are: CA (in-flow decreasing), NM (out-flow about same), TX (out-flow becomes in-flow), WA (in-flow increasing), IL (in-flow increasing), OH (in-flow leveling), MI, in-flow decreasing), NY in-flow decreasing).

- The greatest growth areas in Arizona are the Phoenix metropolitan followed by the Tucson metropolitan area. The areas of greatest growth (in people not rate) of the Phoenix area is Southeast, followed by Northwest.

- The Hispanic component of Arizona's population is significantly higher for those aged 24 or less, and significantly lower for ages 60 and older. While Spanish origin people are 16 percent of the overall population, they have 26 percent of the children under age 4. The distribution is similar for American Indian, with 5.3 percent of the state population and 8.5 percent of the children under age 4. The greatest number of young are found in the rural counties (other than Maricopa and Pima).

- Arizona's population has a higher than national average education but lower than the populous western states (CA, CO, OR, UT, WA). Those ethnic groups which are substantially lower in high school graduates are American Indians and Hispanics, with Blacks intermediate.

- Part-time workers cause employment in some services to appear higher than appropriate when compared with other industries.

II. ECONOMIC CHANGES

- The greatest employment industries (1984) are general services - excluding business and health - (10.2 percent), retail trade -excluding food related - (9.1 percent), construction (7.7 percent), business and repair services (7.4), government - excluding military and schools - (7.2 percent), manufacturing - excluding high technology - (7.2 percent), state and local schools (6.6 percent), Retail trade/eating (6.0 percent), tourism (5.5 percent), health services (5.2 percent), manufacturing - high technology - (5.0 percent), and banking/finance/insurance (4.4 percent)

- Occupational employment in Arizona is production (26 percent), professional (19.5 percent), clerical (18.5 percent), service (17.3 percent), sales (11.7 percent), managerial (6.2 percent), and agricultural (0.8 percent). Maricopa County has 60-70 percent of jobs in all categories except agriculture (57 percent).

- Arizona has a greater percentage of workers than the US average in the following areas: service, government, retail trade, construction, and finance,insurance and real estate and mining. It has less than the US average for manufacturing, wholesale trade, transportation, communications, and public utilities, and agriculture. Increases are expected to be in the 70-90 percent range from 1983 to 2000 except for government, agriculture, and mining.

III. PUBLIC SCHOOL EDUCATION

- Ethnic data are not available for the graduating high school class, but an estimate (by 12th grade class) indicates the proportion of minorities is about a third (ranging from 28 to 38 percent) of the total population in each grades; this is greater in the rural counties. Most of that is Hispanic, with a greater proportion in the early grades. Hispanic and American Indian students have the greatest dropout rate of all minorities (most are stable in their degree of dropout rate). The Black and Asian drop-rate is less than for whites (9th grade to graduation comparison).

- High school graduation projections are important for determining university enrollments, but are difficult to estimate. Growth is likely to continue in numbers of high school graduates through Fall 1989, then drop slightly/level off until about 1995, when the number begins to grow rapidly.

- Arizona ACT scores are slightly higher than the national average and Arizona SAT scores are slightly lower than the national average.

- College preferences (ACT data source) of Arizona high school graduates of the first through sixth choice are ASU, UA, followed by

NAU, then a large drop to Mesa, Glendale, Brigham Young, Phoenix, Pima, Grand Canyon, Military Academies, Scottsdale, UCLA, Stanford, San Diego State University.

IV. HIGHER EDUCATION

- Arizona has 94 percent of its higher education enrollment in public institutions compared to 78 percent nationally. This is higher than any other urban western state.

- Arizona has 46 percent of its college students full time compared to 58 percent nationally.

- Arizona relies more heavily on community colleges (46 percent of FTE enrollments) than the national average (38 percent).

- Arizona higher education enrollment in fall 1986 was 57.6 percent community college, 38.8 percent state universities, 3.4 percent private colleges, and 0.2 percent bible colleges.

- In the 5-year period 1981 to 1986 the state population increased 19 percent and the higher education (community college and university) FTE enrollment grew 2.3 percent

- In the 10-year period 1976 to 1986, FTE enrollment for Arizona universities was relatively constant, varying between 61,608 and 68,055 (two years had declines); from 1980 to 1985 there was actually a decline from 66,417 to 66,172.

- In the 10-year period 1976 to 1986, headcount enrollment for Arizona universities gradually increased from 73,426 to 85,827; in the last five years (1981 to 1986) it grew more slowly from 81,465 to 85,827.

- In the 10-year period 1976 to 1986, the FTE enrollment of Arizona universities per Arizona population was a gradual and steady decline from 48 per 1000 to 36 per 1000

- In the 1980 census, 20 percent of the high school graduates in the 18-24 age group were minorities. In the community colleges, 20 percent of the enrollments were minority, and in the universities, 11-14 percent of the enrollments were minority.

- The states where Arizona high school students (over 100 each for all students categories Fall 1984) attend colleges are California, Kansas, Texas, Utah, New Mexico, Colorado, Florida, New York, Idaho, Missouri.

- The states from which Arizona colleges and universities receive students (over 300 of all student categories Fall 1984) are California, Illinois, Colorado, New Mexico, New York, Michigan (the sequence is the same for new freshmen as well as total students).

- The residencies of new students (over 100) enrolled in Fall, 1984 at selected Arizona universities are ASU (California, Illinois, Colorado, New York, Michigan, Minnesota, Wisconsin, Washington, Ohio, Oregon, Texas), NAU (California), UA (California, Illinois, New York, Colorado).

- ASU gets 53 percent of transfers from community colleges and between the universities, UA gets 26 percent, and NAU gets 20 percent;

ASU gets more community college transfers from Arizona (1991) that it gets in new Arizona freshmen (1958) for (Fall 1987)

- More than 84 percent of ASU undergraduate students are full time and 82 percent of all full time undergraduates are in between 18 and 24 in Fall, 1987.
- The Fall, 1987 headcount undergraduate on-campus students at NAU in the 18-24 age bracket are 78 percent of on-campus enrollment. On-campus enrollment accounts for 85 percent or total enrollment, or 97 percent of undergraduate and 45 percent of graduate. The off-campus enrollment is essentially all graduates, and is primarily adults beyond age 25.

- For academic year 1985-86 the fields of largest study (credit hours) at ASU were Social Science, Business and Public Policy, Engineering, Education, and Visual/Performing Arts.

- For academic year 1985-86 the fields of largest study (credit hours) at UA were Social Science, Letters, Physical Science, Engineering, and Business and Public Policy.

- For academic year 1985-86 the fields of largest study (credit hours) at NAU were Social Science, Education, Letters, Business and Public Policy, and Mathematics.

- Comparing number of bachelor degrees awarded in Arizona universities per 1000 undergraduate enrollment by ethnicity (FY 86), the least awards were to American Indians followed by Blacks. Hispanics were near Asians and Whites were the highest (the figures vary by university).

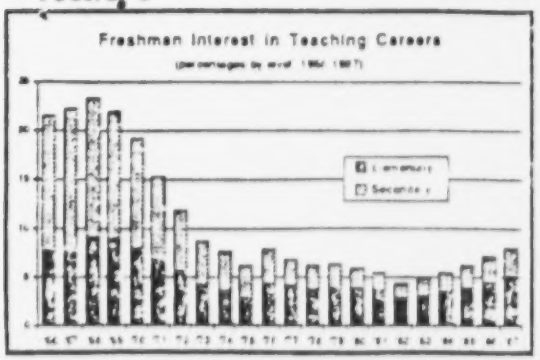
- Bachelor degrees for FY 86 at Arizona universities (comprising 50 percent of all degrees) were business and management (over twice the next entry), education, engineering, and communications. Masters degrees are education (over twice the next entry), business and management, and engineering. Doctoral degrees are education (twice the next entry), physical sciences, and life sciences.

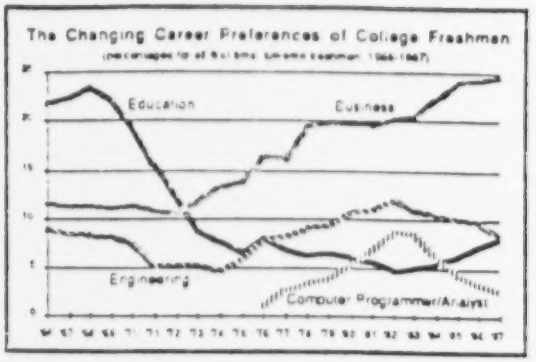
- Research funding expenditures as reported by the National Science Foundation indicate (FY 85) that Arizona is higher in physical sciences, environmental sciences, and social sciences, and less in life sciences, computer sciences, mathematics, and psychology than the national average (note that Education funds are not included in this analysis).

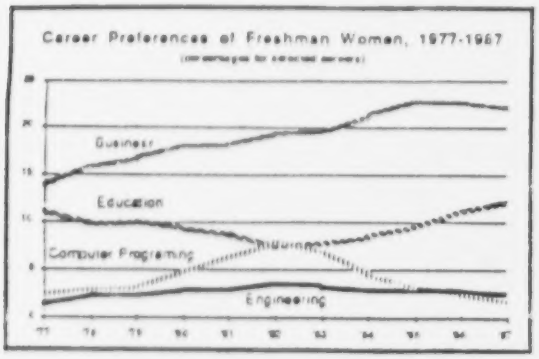
ADDITIONAL FIGURES

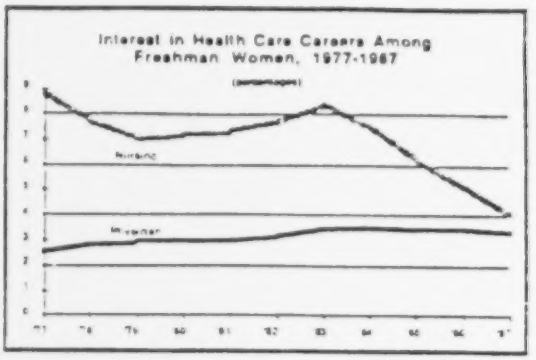
1987 Freshman Survey Data

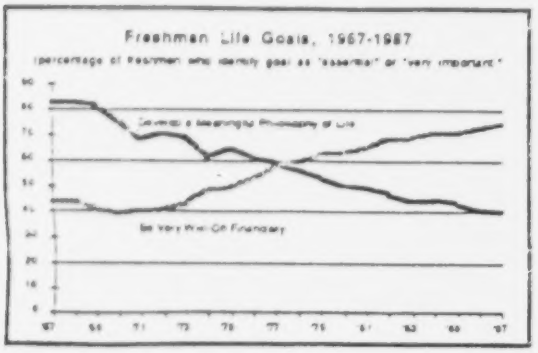
FIGURE 1

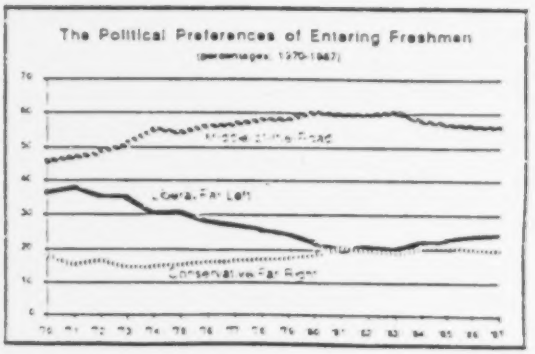


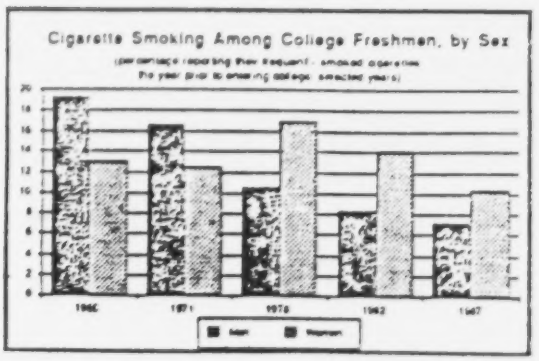












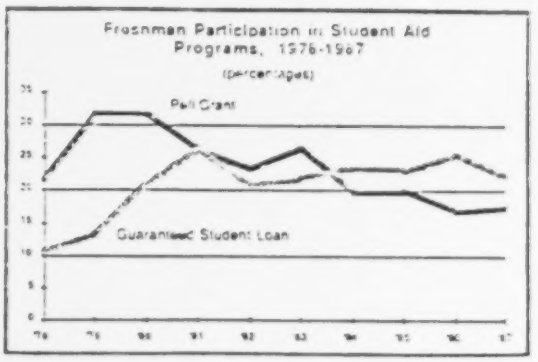
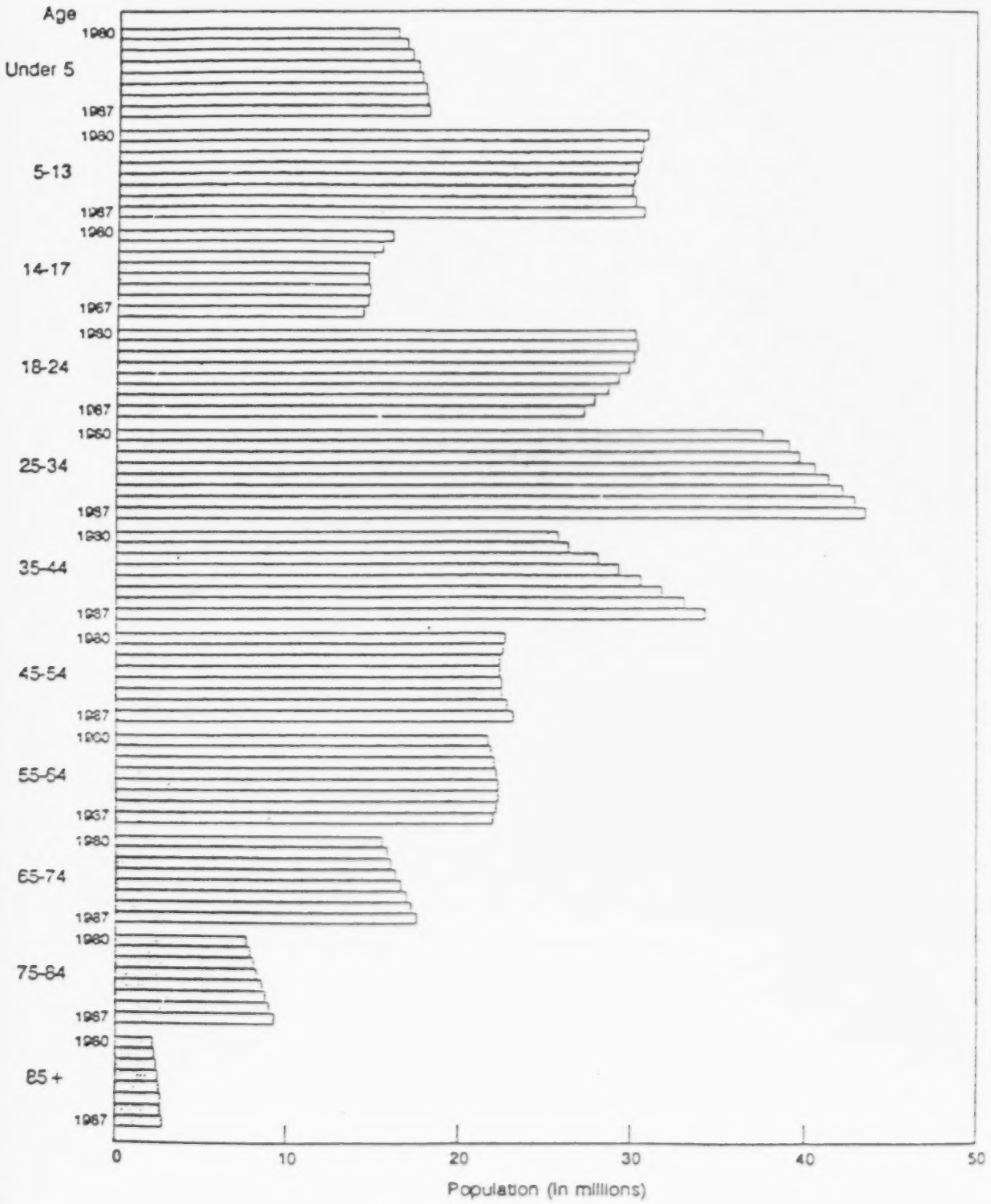


Figure 3.
Total Population Including Armed Forces Overseas, by Age: July 1, 1980-87



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END NOTES

1. These driving forces are summarized from more detailed trends and forecasts identified in Part I and Part II of this paper.

2. For a more detailed review of possible impacts of biotechnology, see Biotechnology: Strategies for Life, Elizabeth Antebi and David Fishlock, MIT Press, Cambridge, MA, 1986; and Science Magazine, 10 June 1988, V240: 1377-1580, Frontiers in Biotechnology.

3. See Ritchie, David. 1988. Superquake! Why Earthquakes Occur and When the Big One Will Hit Southern California, Crown Publishers, 185 p; and California's Quakes Forecasted, Science Magazine, 22 July 1988, 413-414.

4. For a more detailed description of the issues relating to a earthquake see U.S. Geological Survey ....

5. For further discussion see Peter Peterson, The Morning After, in Atlantic Monthly, October 1987, 43-69; and Lester Thurow and Laura D'Andrea Tyson, The Economic Black Hole, in Foreign Policy, Summer 1987, 3-21.

6. See Jorge Castaneda. 1986. "Mexico's Coming Challenges." Foreign Policy, Fall 1886 p 120-139; and Thomas Merrick. 1986. "Population Pressures in Latin America." Population Bulletin, July 1986 p 1-51; and Benjamin Orlove, Michael Foley and Thomas Love. 1988. "State, Capital, and Rural Society: Anthropological Perspectives on Political Economy in Mexico and the Andes", Westview Press, Boulder, Colorado, 320 p.

7. For further information see: Chernobyl: The End of Nuclear Power?, Special Issue, The Ecologist 16:4/5, 137-221, 1986; and The Renewable Energy Alternative: How the United States and the World can Prosper Without Nuclear Energy or Coal, John Blackburn, Duke University Press, 1987; and Impending United States Energy Crisis, Robert Hisrch, Science, 20 March 1987, 1467-1472.

8. For further information see: The Next Arab Decade: Alternative Futures, by Hisham Sharabi, Westview Press, Boulder, Colorado, 1988; and Toward Arab-Israeli Peace: Report of a Study Group, Brookings Institution, Washington, 1988.

9. For further information see: Space 2000: Meeting the Challenge of a New Era, by Harry Shipman, Plenum Press, 1987; Space Resources: Breaking the Bounds of Earth, by John R. Lewis and Ruth A. Lewis, Columbia University Press.

10. For further information see: Societal Responses to Regional Climatic Change: Forecasting by Analogy, by Michael H. Glantz, National Center for Atmospheric Research, Westview Press, Boulder, CO, 1988.

11. For further information see: Terrorism and Global Security: The Nuclear Threat, by Louis Rene Beres, Westview Press, Boulder, CO, 1987; and Spies, Terrorists, and US Border, by John Dillon, The Christian Science Monitor, 24 March 1986, page 1; and America the Vulnerable: The Threat of Chemical and Biological Warfare, by Joseph Douglass Jr, and Neil Livingstone, Lexington Books, Lexington, MA, 1987.

12. A more detailed description of the Arizona universities is in the working paper "Arizona Universities in Transition".

13. Percentage of degrees for those disciplines comprising 40 percent or more of total degrees in each category. Arizona universities' total percentage in two-year period FY 87 and FY 88; national average for FY 84. Categories defined by Higher Education General Index.

14. These recommendations are also found in the Working Paper titled "Foresight: Definition and Need for Arizona Universities."

15. An overview of report was made available in April 1988 with the title "Some Thoughts About Approaching the Future of Arizona", 5 p.

16. Published by the World Future Society and edited by Michael Marien. Used with permission.

17. United Way of America. 1987. What Lies Ahead: Looking Toward the '90s." 86 p.

18. Cetron, Marvin J., Wanda Rocha, and Rebecca Luckins. 1988. Into the 21st Century: Long-Term Trends Affecting the United States. The Futurist XXII(4) 29:40.

19. The 16 states are Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming.

20. Western Interstate Commission for Higher Education, 1987 From Minority to Majority: Education and the Future of the Southwest." Boulder, Colorado. 38 p.

21. Arizona Department of Economic Security. 1986. Hispanics in Transition. 22 p.

22. See Working Paper "Executive Summaries of Reports and Books on Higher Education."

23. Michael, Don. 1985. New Competence: Management Skills for the Future; Drucker, Peter F. 1988. The Coming of the New Organization. Harvard Business Review 80: 45-53.

24. The Arizona Academy and the Arizona universities have a unique relationship, in which the universities prepare research reports for Academy identified societal concerns. The universities might take particular advantage of the subsequent Academy recommendations in forming the universities' planning activities.

25. Urban Growth in Arizona: A Policy Analysis was developed by the Morrison Institute for Public Policy at ASU for the Joint Interim Committee on Urban Growth Issues of the Arizona Legislature. Copies are available from the office of Senator John T. Mawhinney, Co-chair of the Joint Committee.

26. Additional indicators of public interest in the Future include: The "Arizona Looks to the Future" conference (sponsored by 27 businesses and non-profit groups but was focused on Southern Arizona in September 1987), and a 1987 commissioned study by Neal Peirce for the Arizona Republic and Phoenix Gazette (Urban Challenges: A Vision for the Future).

27. This 1987-88 study expanded a similar study undertaken by Arizona State University. The authors are Jack Bartram and Melenda Gebel.

28. Arizona: The State and Its Educational System, Harold L. Hodgkinson, Institute for Educational Leadership, Washington, D.C. April 1988, 14 p.

29. The CIRP study is under the direction of Professor Alexander Astin at the University of California, Los Angeles. The current survey results are available as "The American Freshman: National Norms for Fall 1987, Cooperative Institutional Research Program, UCLA, and American Council on Education. 165 p.

30. See, for example, Chronicle of Higher Education, "Today's Students Flock to Courses About 1960s," May 25, 1988, p A33; and Paul Taylor, "The Coming of the "We" Decade", The Washington Post, Sunday, 20 July 1986, D1.

31. These three reports are summarized using much of the original wording but are not verbatim statements of the original reports.

32. Developed by Professor David F'ane, Department of Geography and Regional Development, University of Arizona, 1988.

33. Western Interstate Commission for Higher Education "High School Graduates: Projections by State, 1986 to 2004." The Arizona projections should be considered as probable high estimates because the data source is taken directly from the Department of Economic Security projections and does not compensate for anticipated lowered migration rates due to demographic shifts in age groups. Published March 1988 and available from WICHE, Denver, Colorado.

34. Jack Bartram and Melinda Gebel "Arizona Environmental Scan" prepared for Task Force, 1988.